Mr. Plana
With the Author's Respects

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ON

THE DISCORDANCES BETWEEN
THE SUN'S
OBSERVED AND COMPUTED RIGHT ASCENSIONS,

AS

DETERMINED AT THE BLACKMAN-STREET OBSERVATORY,

DURING THE YEARS 1821 AND 1822;

WITH

EXPERIMENTS TO SHOW, THAT THEY DID NOT ORIGINATE IN INSTRUMENTAL DERANGEMENT.

ALSO

A DESCRIPTION OF THE SEVEN-FEET TRANSIT

WITH WHICH THE OBSERVATIONS WERE PROCURED, AND UPON WHICH, THE EXPERIMENTS WERE MADE.

BY

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W. T. BRANDE, Sec. R. S.

ON

THE DISCORDANCES, *&c.*

Read before the ROYAL SOCIETY, *June* 8, 1826.

IN presenting to the Royal Society the following pages, I am well aware that some apology is necessary; the subject however to which they refer being intimately connected with the progress of astronomy, I am induced to hope that the Society will still receive with indulgence, what would long since have been communicated to them, had other astronomical pursuits allowed me the opportunity.

That the sun's right ascension, found by *observation*, frequently disagrees with that afforded by *calculation*, astronomers I believe now generally admit; an opinion however has been as generally entertained, that the discordances were the results of instrumental inaccuracy, occasioned by the effects of the solar rays upon certain parts of the instrument; hence observations of the sun have fallen into disrepute, whenever an accurate knowledge of the time is the object of research.

As, however, there is nothing which more impedes the advancement of science, than opinions too hastily adopted, it may be worth while to inquire whether practical astronomy

really merits the above reproach; the investigation will be tedious, but I trust it will be satisfactory.

The transit instrument employed for the purpose was made for me by Mr. Troughton; its object-glass is four inches in clear aperture, its focal length seven feet two inches; and as far as the just proportions of its parts are concerned, it is regarded by him, as his happiest production. Experience having also shown that it is one which future artists will do well to *imitate*, a brief description of it will perhaps be grateful to the Society.

The instrument in its general construction is similar to that of the ten feet transit, which was in the year 1816 erected at the Royal Observatory at Greenwich; there are however some trifling differences, which will be mentioned hereafter.

In Plates XVI. and XVII. figures 1 and 6, the instrument is shown on a scale of one-twelfth of the real dimensions. The telescope (as well as the axis), is formed of conical tubes, the extreme ends of which are determined by the diameter of the object-glass, whilst the larger ends take their dimensions from that of the spherical centre piece, which forms a base for them to rest on. In the two figures just referred to, the centre piece has nearly four-sixths of its surface covered by the four truncated cones of the axis and telescope; but it is not rendered weak by the perforations made in it, those in the direction of the telescope being but a little more than the radius of the object-glass, whilst those in the direction of the axis are no larger than is required to transmit the light of a lamp placed near the end of the axis, uninterruptedly to the central illuminator. The figures 1 and 6 of Plates XVI. and XVII. do not at all show how the four

principal parts of the instrument are united to the sphere, but figures 8 and 9 of Plate XVIII. will illustrate a description of what is hitherto *peculiar* to the Greenwich transit instrument and mine.

The ends of all the four cones, where they join the sphere, are strengthened by circular pieces of cast brass; these pieces extend full three inches into the lengths of their respective cones, into which they are soldered and pinned; they are turned concave in front, so as to fit the surface of the sphere, into which they are rabbeted, and serve to keep the opposite branches of the axis and telescope straight, and at right angles with each other. To these brass pieces are attached broad and strong rings, for the reception of the screws which bind the whole together.

The four branches of the axis and telescope are solely united, by what Mr. TROUGHTON calls, *tension bars;* these bars pass through the sphere, six of them in the direction of the axis, and four in that of the telescope. They are arranged at equal distances between corresponding parts, care being taken that those of the axis do not obstruct the rays of the object-glass, and that the illuminator is not shadowed by those of the telescope. The tension bars screw into the rings of the brass pieces above described; they have at one end a fine screw, and at the other a coarse one; the fine one is made about twice as long as under other circumstances would be required: and there are holes in the sphere at proper distances, through which the bars can pass freely.

To connect these various parts, let the fine screw ends of the six bars of the axis be screwed into their proper rings as far as they will go; then pass the bars through the holes in the sphere, and pressing the cone home upon the rabbet

retain it there: now address the other cone to the coarse screw ends of the bars, and by turning these in the direction of unscrewing, they will screw into their rings, and bring up the other cone to its bearing, with a power equal to the difference of the ranges of the two screws. The tubes of the telescope are united to the sphere and to each other in the same manner; but to perform this operation, it is necessary to pass the hand into the sphere, for which purpose there are two apertures, with moveable caps left in the middle of its two uncovered parts: the tension bars are acted on by a capstan pin, small holes having been drilled in the bars to receive it. The above caps are covered with platina; on one of them is engraved an inscription, and on the other the maker's name. By the above mode of joining the principal parts, the bars may be stretched, and the sphere* even compressed to any extent short of that, which would occasion a permanent alteration in the length of the former, or in the figure of the latter; a thing which Mr. TROUGHTON considers would perhaps not take place with a force equal to a ton of weight. How much such a connection must be better than any that could be effected by binding together the *exterior* parts, to use the emphatic language of our illustrious artist, "every one who is gifted with mechanical intellect will readily determine."

Plate XVIII. fig. 8, is a section through the axis, and exhibits the six bars which bind together, the cones of the axis, and also the places of the four, which are perpendicular to them, and which connect the tubes of the telescope. In Plate XVIII. fig. 9, which is a section through the telescope,

* That every part of the sphere, should possess a power of resistance, as uniform as possible, extreme precaution was employed, in turning its interior surface, so as to render it concentric with the exterior.

the bars of the telescope are shown lengthwise, whilst those of the axis are perpendicular; in both figures the illuminator is shown, in one the polished surface, the back of the plate in the other; in each it is seen under an angle of 45°, the elliptical perforation appearing as a circle. The removal of the inscription pieces having afforded the draftsman but a limited view of the interior of the sphere, the parts are not represented with precision; but nevertheless may serve well enough to elucidate the preceding description.

In Plate XVII. fig. 6, extending from the cones of the axis to those of the telescope, will be seen four tubes or braces, attached to the former about two inches from the pivots, and to the latter about ten inches from the centre piece; these are so placed as to exert but a very slight pressure, and although deemed by Mr. Troughton *essential* in the Greenwich instrument, were considered *unnecessary* in mine, and for the diminution of expence, would have been omitted but for my interference; in the Greenwich transit they were applied to counteract any disposition to flexure, when the instrument was directed to the horizon; and although the greater length of the Greenwich instrument, would render such an effect more likely to happen than in mine, still, as I had never heard the Astronomer Royal speak but in terms of the highest commendation of *his* instrument, I deemed it consistent with good sense to *profit* by his experience.

Until the Greenwich transit was constructed, the method of placing the telescope to the required altitude, was by means of a semicircle fixed to one of the side pieces, and an index clamped to the pivot of the axis, the vernier of which pressed slightly upon the former. The index in this arrangement is

very liable to be disturbed on reversion of the axis, and when the object-end of the telescope accidentally points below the horizon: also, after the index is set, should the position of the telescope be deranged before the observation is commenced, reference must be again made to the divisions of the semicircle; and should the accident occur whilst the star is passing the wires, the observation will be lost. The apparatus to remedy these inconveniences is seen in Plate XVI. and XVII. figs. 1 and 6, but better in Plate XVI. fig. 2, which is drawn to a scale half the dimensions of the original. It consists of two complete circles, firmly attached to the eye-end of the telescope; each circle is provided with two opposite verniers, subdividing its divisions into minutes of a degree; the indices have clamps and slow moving screws, and microscopes are attached to the verniers: a spirit level is also affixed to the index of each circle, whose range of bubble corresponding to one minute, is about half an inch. When this apparatus is adjusted, on the vernier being set to the place of a star, and the telescope moved round till the bubble stand in the middle of its range, then will the star traverse the field between the two horizontal wires.* Hence it is evident, that should by accident the telescope be moved before, or during observation, the merely restoring the bubble to the middle of its range, will again present the star to the observer's view, without any reference to the divisions. But it is often of importance to observe the transits of stars, one of which, in right ascension differs very little with the other; as for instance, Capella and Rigel; here the index of one circle may be set to the first star, whilst that of the other may be placed to the second;

* These wires are distant from each other, about four minutes of a degree.

and when observations by direct vision, are to be compared with those obtained by reflection, the index of the one, will point the telescope to the direct place of the star, whilst that of the other, will present the instrument to its reflected image.

Figures 3 and 4, of Plate XVI. exhibit the side pieces and Y s in which the pivots of the axis rest; the plates which are semicircular, are imbedded in the stone piers, and are firmly screwed into them. Figure 3, represents the eastern plate, in which the adjustment for the level of the axis is made: a piece, of which the upper end is formed into a Y, is moveable perpendicularly, but well secured from motion in every other direction; the means of gradual adjustment are brought about, by a piece having a short cylindrical part in the middle, at the upper end a fine screw, and at the lower end a coarse one; the fine screw works in the moveable piece, and the coarse one in the fixed plate; the cylindrical part being perforated in many places, enables it to be acted upon by a capstan pin, and thus an effect equal to the difference of the two screws, is produced. This last part, because easy of description, was not brought under the view of the draftsman, by removing the covering plate; a slit in it however exposes two or three of the capstan holes of the differential screw.

Fig. 4, Plate XVI. shows the western plate, the general outline of which corresponds with that just described; the motion of the Y piece is here only horizontal, for the purpose of placing the instrument in the meridian. The adjustment is effected by means of two screws, which work in the opposite sides of the moveable Y piece, and whose heads abut against the fixed plate To produce motion in the Y piece, one of them must be screwed, and the other unscrewed; but in order

that the screws might be both moved at the same time, by equal quantities, and when the observer's eye is at the telescope, there is a system of pinion work, the handle for which adjustment is seen in Plate XVII. fig. 6, hanging down close to the inside of the western pier. In the formation of the side plates very great attention was paid to render them steady in themselves, as also that their respective adjustments should not disturb each other.*

Fig. 5. Plate XVI. is a bird's-eye view of the head of one of the piers, and was meant chiefly to show the apparatus for relieving the pivots of the axis, and Y', from a great part of the weight which would otherwise bear upon them. Immediately behind the adjustable Y piece, but rather broader, is a plain piece of brass, having a Y cut in its upper end; a lever also is seen, one extremity of which passes into a hole made in the Y piece just alluded to, whilst the other end carries a weight; the bar of the lever is expanded into a circle, whose centre is about one-third of the lever's length distant from the pivot of the axis. The circle is sufficiently large to admit the illuminating lantern; in its diameter at right angles to the direction of the lever are inserted two steel screws, whose blunted points are hardened and polished; these rest on hardened and polished steel planes, which are let into the stone pier, and together form the fulcrum in a manner not

* How completely this desideratum has been attained, it is only necessary to remark, that on the 9th of May, 1822, the western side plate was removed from its pier, in order that Mr. TROUGHTON might apply to it, the pinion work just alluded to; on the 19th of the same month it was returned to me; and although not even an approximate meridian mark was at my command, still, by one observation of the pole star on the same evening, the instrument was placed so nearly in the plane of the meridian, that by the subsequent transits of Arcturus and α Libræ, its ex-meridian position could not be detected.

unlike the common balance. The weight is a circular thick plate, or short cylinder, and is hooked on to the end of the lever; it is made hollow, with an opening upon it's superior edge, allowing small shot to be introduced at pleasure, according as it is wished that the instrumental portion of the pivot, as also the instrumental Y piece, should be more or less relieved. A reference to fig. 5, Plate XVI. will render all this perfectly intelligible.

Fig. 7, Plate XVII. is a perspective view of the eye end of the telescope, in which many of the parts above described are differently, and some of them better seen. In it a micrometer is shown, which moves a plate contiguous to that in which the five transit wires are inserted; one wire is contained in the moveable plate, and is intended to facilitate the observations of Polaris, and other juxta polar stars.

In fig. 6, Plate XVII. on the eastern side of the telescope, is seen projecting from it a finger screw; this gives motion to an apparatus within the tube of the telescope, for regulating the quantity of light projected from the illuminator upon the transit wires of the instrument.

The instrument was placed upon its piers on the 6th of June, 1820, and on the day following a series of experiments was begun, to find, if possible, any defects which might invalidate the accuracy of observations hereafter to be made with it; the permanency of the side plates, and of the Y pieces contained in them, was incessantly scrutinized; observations by reflection and by direct vision were compared; continual reversions of the instrument were made; constant examination of the horizontality of the axis, after every alteration of instrumental position, was never omitted; and the state of its

collimation was frequently ascertained.* The results having satisfied my astronomical friends as well as myself, that the instrument fulfilled all the required conditions, further experiments were deemed unnecessary; and on the 5th of August, the instrument being relieved from its two months' "torture," was prepared to grapple with the delicate observations for which it was designed.

The character which the instrument acquired shortly after its erection, four years' subsequent experience has unequivocally confirmed; and exclusive of the property which it is the object of the subsequent pages to investigate, I know not whether most to respect it, for the *unusual* accuracy with which it obeys its adjustments, or for the *extreme* pertinacity with which it retains them.

The object glass of the Greenwich Transit instrument is five inches in clear aperture; its focal length is 10 feet; its horizontal axis, including the pivots, is 3 feet 10 inches; in the focus of the object glass are seven fixed wires, and two moveable for micrometrical purposes; the semicircles at the eye end of the telescope, being insufficient to enable the

* The proximity of lofty buildings to the north and south of my Observatory, rendering it impossible to erect any object to perform the offices of a meridian mark, an apparatus was planted upon the top of my house, enabling me to examine the collimation, by the flag-staff on Severndroog Castle. The trouble, however, of frequently repeating the operation became so considerable, and from unfavourable state of atmosphere, occasionally so unsatisfactory, that sidereal observations were recurred to, generally of Polaris, and of a small star about 54 minutes from the pole: these, particularly the latter, offer severe tests for the accuracy of the adjustment; and where the instrument can be reversed, without risk of deranging its *horizontality*, (as is the case with *mine*,) no error of collimation, sensible to observation, *need* remain uncorrected.

observer to direct the instrument to the reflected image of a star, a divided circle two feet in diameter, is attached to one end of the axis; the pivots, originally of hard bell metal, having suffered an alteration of figure from constant use, were removed during the spring of last year by Mr. TROUGHTON, and others, made of hardened steel, inserted in their stead. There is no apparatus whereby the observer, whilst making sidereal observations, can communicate to the instrument, azimuthal motion.

With these exceptions, the Greenwich Transit is the same as mine; the description therefore given of the one, will convey nearly an accurate idea of the nature of the other.

The computed Right Ascension of the Sun, with which his Right Ascension as determined by observation, will be compared in the subsequent pages, is that given in the Nautical Almanac and Astronomical Ephemeris for the respective years, where it stands computed for the meridian of Greenwich; the comparisons, however, being those arising from observations made at another station, *viz.* Blackman-street Observatory, it becomes necessary to inquire, how far equations can be found, adequate to reduce the sun's right ascension computed for Greenwich, to his right ascension when on the meridian of Blackman-street. This is a matter which observation must decide.

Tables I. and II. show various right ascensions of the sun observed in Blackman-street during the years 1821 and 1822; the former presents sixteen, the latter nineteen transits of the sun made on consecutive days; the maximum difference between the *observed* daily motion in right ascension

and the *computed* daily motion in right ascension, is 26 hundredths of a second in the one, and 22 hundredths in the other; in the former table the mean difference of sixteen comparisons is only 4 hundredths of a second in time, whilst in the other it is only 3 hundredths. Hence, there can be no doubt, that we may safely enough employ the computed daily motion in right ascension, to arrive at accurate corrections of the sun's computed right ascension, for the differences of longitude of the two observatories.

Tables III. and IV. contain the sun's right ascension computed for the meridian of Blackman-street, on such days as the sun's transit was observed there, during 1821 and 1822, also the equations employed for the purpose; the longitude of Blackman-street Observatory being 21.76 seconds of time west of the Royal Observatory at Greenwich.

Tables V. and VI. exhibit the difference between the sun's observed and computed right ascensions, as determined in Blackman-street during the years 1821 and 1822; these require explanation.

The Observatory being situated in one of the principal manufacturing, as well as in one of the most populous, districts of the metropolis, the instruments were exposed to the inconveniences of soot falling upon them, from the chimneys of the neighbouring houses, steam engines, &c.; and the transit, from the nature of the opening in the roof, came in for its full share: to protect its tubes, therefore, from the ravages of the soot, they were, shortly after the erection of the instrument, covered with green woollen cloth, which being neatly fitted and attached by buttons, afforded no incumbrance during the observations. The openings in the roof to the

north and south were about 18 or 20 inches in breadth; and the telescope, when directed to the zenith, extended some way between the ceiling of the observatory and its roof. The shutters were so contrived as to be opened in an instant; and by a slight frame-work it was very easy to screen all the parts of the instrument, and also the piers, from the access of the sun's rays; it was likewise a matter of the greatest facility to prevent his rays from falling on the eastern half of the instrument, whilst the western was exposed to their influence.

Previous to observing the sun's transit, it was my ordinary habit not to open the shutter, till his first limb had nearly reached the first wire of the instrument. This precaution was uniformly adopted, in the observations of 1821, till the 22d of August; the consequences are seen by the annexed differences.

If, however, we adopt the hypothesis, that the mere exposure of the instrument to the sun's rays during the observation of his transit (a period about $4\frac{1}{2}$ minutes) be adequate to produce instrumental derangement corresponding to 8 or 9 tenths of a second in time, it is fair to expect that a longer exposure would produce a greater discordance, and vice versâ. On the 22d of August, therefore, the western * half of the instrument was exposed to the solar rays, 18 minutes before the sun's centre came to the meridian; the effect, however, being very inconsistent with theory, on the 23d it was exposed 24 minutes; the mean differences of temperature of the western and eastern axes, and western and eastern

* By the nature of the roof, and the construction of the interior of the observatory, independently of the shutter and screen, the sun's rays could not fall on the eastern brace and axis, 'till the sun had nearly reached the meridian; but the western brace and axis, towards the pivot, were accessible to his rays nearly $1\frac{1}{2}$ hour before noon, provided the shutter was opened.

braces being 14 degrees, but without any evidence of increased displacement.

On the 24th of August, the western half of the instrument was exposed 65 minutes before noon, still without any material difference; indeed, if the observations could be relied upon (which they certainly cannot), to 7-hundredths of a second of time, the result of this day's exposure of the instrument, would militate against the hypothesis, that the sun's rays have any thing to do with the matter, seeing that the difference is in the negative sense.

On September 2nd, all the coverings were removed from the instrument, and it was defended from the solar rays, till the sun's first limb had nearly reached the first wire. On September 3rd, the instrument* without its coverings, was exposed to the sun's rays, 59 minutes before his centre came to the meridian; the difference between the thermometers on the western axis and brace, and those on the eastern, being nearly 14 degrees, yet the discordance between the results of the two days transits, is absolutely insensible.

On September the 4th, the instrument was entirely defended from the sun's rays. On the 5th, the western braces and axis, also the western half of the centre piece being covered with black cloth, whilst those on the eastern half were enveloped in white, the instrument was exposed 65 minutes before noon, to the sun's rays; thermometers placed under the covers of the western axis, and western brace, stood 13°.5 higher, than those placed under the covers of the eastern axis and brace; yet the discordance between the observed and computed right

* Previously to the shutter being opened, for the experiments of exposure, the instrument was always elevated to the sun's altitude; and it remained so, until the transit was observed: during the experiments, the windows and door of the observatory were closed; the thermometers employed, were made by Mr. Troughton.

ascensions, varies only one thousandth of a second, from the quantity obtained on the 4th, when the instrument was entirely defended from the solar rays.

On September 24th, the instrument was completely screened from the sun's rays; but on the 25th they were allowed to fall upon the instrument's western axis and brace, sixty-three minutes, during a cloudless sky;* yet between the results of the one day, and the other, there is only a difference of 7 hundredths of a second.

On October 21st and 22nd, the instrument being exposed to the sun's rays, thermometers under the black covers of the western axis and brace, differed on the former day 12°.5 from those under the covers of the white axis and brace; but on the latter, the difference of temperature was more than 16°; the difference between the results of the two days' observations, is nine hundredths of a second: unfortunately, there are no observations with which these can be compared.

In like manner might we discuss individually, the results of experiments made on several occasions, during the year 1822; the days however are noted in Table VI. when the instrument was exposed; and Table VII. details all the particulars which are essential to the investigation; to which therefore the reader is referred, as also for a more circumstantial account of the exposure of the instrument to the sun's rays, during the year 1821.

On looking down the columns of differences, between the *observed* and *computed* right ascensions of the sun, from the

* Experiments during exposure of the instrument, were never commenced, except under every probability of success; when however (as frequently happened), transient clouds obscured the sun, even but for half a minute, the operations were discontinued, and the results disregarded and destroyed.

various determinations of 1821 and 1822, exhibited in Tables V. and VI. it will be seen, although the difference is not constant, yet that within two or three days, its amount does not greatly vary; by collecting therefore consecutive transits, in pairs, each of which shall always contain a result, derived from observation made during exposure of the instrument, we may probably arrive at some conclusion, which, although not demonstrative, will still merit considerable confidence. Let us begin with 1821.

From Table V. 1821.

Instrument exposed.		Instrument defended.		Difference.
	seconds.		seconds.	seconds.
August 22	+ 0.755	August 21	+ 0.733	+ 0.022
Sept. 3	+ 0.672	Sept. 2	+ 0.661	+ 0.011
—— 3	+ 0.672	—— 4	+ 0.661	+ 0.011
—— 5	+ 0.660	—— 4	+ 0.661	— 0.001
—— 25	+ 0.701	—— 24	+ 0.773	— 0.072
		Mean diff. of the 5 pairs =		— 0.0058

From Table VI. 1822.

Instrument exposed.		Instrument defended.		Difference.
	seconds.		seconds.	seconds.
March 1	+ 0.030	February 28	+ 0.225	— 0.195
May 21	+ 0.861	May 22	+ 0.932	— 0.071
—— 31	+ 0.971	June 1	+ 0.826	+ 0.145
June 2	+ 0.826	June 1	+ 0.826	+ 0.000
—— 2	+ 0.826	June 3	+ 0.873	— 0.047
—— 4	+ 0.704	June 3	+ 0.873	— 0.169
—— 7	+ 0.705	June 6	+ 0.927	— 0.222
Decem. 22	+ 0.164	Decem. 23	+ 0.158	+ 0.006
		Mean diff. of the 8 pairs =		— 0.0691

Hence, in 1821, the mean of 5 observations, obtained when the instrument was exposed to the sun's rays, varies from

the mean of 5 observations, made when the instrument was entirely defended from their influence, six thousandths of a second of time; whilst in 1822, the mean derived from 8 observations made under exposure, compared with the mean of 8 results, obtained when the instrument was completely defended from the sun's rays, differs sixty-nine thousandths of a second of time.

The mean therefore of the two series, allowing each, a weight proportional to the number of observations on which it rests, is forty-five thousandths of a second of time. Whether this arise, from error of observation, erroneous computation, or from instrumental derangement, we have not sufficient data* to determine: fortunately, however, the quantity is very small, and if it really *could* be brought, to support the hypothesis, " that the sun's rays falling unequally upon the instrument, occasioned the discordances complained of," it would lose much of its apparent weight, when it is remembered, that not the ordinary exposure of the instrument to the sun, but ten times that quantity, was employed to procure it.

The mean difference however between the observed and computed right ascensions is *less* under exposure, than when the instrument was defended; hence, were it wanted, it might be called upon as additional evidence, in favour of the conclusion which the experiments afford, namely, " that the discordances between the *observed* and *computed* right ascen-

* On referring to page 26, there seems some reason to believe, that the differences found between the observations of February 28th and March 1st, May 31st and June 1st, June 3rd and June 4th, June 6th and June 7th, are *not* the results of instrumental derangement, *nor* of erroneous observation. The Greenwich and Paris observations corroborate our 1st difference; the mean of the Greenwich and Paris, supports our 2d; the Paris determination coincides with our 3d; and the Dublin is nearly similar to our 4th.

sions, as determined by the Blackman-street observations of 1821 and 1822, were *not* the consequences of instrumental inaccuracy."

To obtain however these results, we have been obliged to recur to the sun's right ascension, as computed in the Nautical Almanac; it is therefore possible, that the near coincidences above indicated, may arise from a balance of errors, between derangement of the instrument on the one hand, and inaccurate calculation on the other; we will therefore appeal to experiments, which shall be independent of astronomical tables.

The brightness of the pole star, and the difference of polar distance between it, and the sun, render it visible in the day time, throughout the year: during the spring and autumn, it comes to the meridian about noon; in the former, at its superior, in the latter, at its inferior transit; in the one instance, the sun is about 8° north, in the other as much south of the equator; the arc therefore intercepted between the star and the sun, being about 20° greater in autumn, than in the spring, observations of the star, will be gotten with greater facility in the former, than in the latter.

With the ordinary observing power of 250, the transit of the star, when *very* steady, may be determined by my instrument, to half a second of time. If therefore, the sun's rays can occasion such instrumental derangement, as may be easily perceptible by the sun's transit, we must expect that their power will be incontrovertibly established, if observations of the pole star, made under exposure of the instrument to the sun's rays, be compared with those made, when the instrument is defended from them.

Table VIII. shows the observed transits of the pole star, during the autumns of 1821 and 1823; also the nature

and extent of the exposure, to which the instrument was subjected.

Table IX. indicates the portions of time, in which the pole star passed to the several wires, when the instrument was exposed to the sun's rays; whilst Table X. gives the like information, when the instrument was entirely defended from them.

Table XI. shows the difference between the intervals of time, in which the pole star passed to the several wires, when the instrument was exposed to, and defended from, the sun's rays; and the results for two adjoining wires, are as follow:

Seconds.	
− 0.17	From the observations of 1821.
− 1.25	
− 1.00	
+ 0.17	
+ 1.25	
− 1.00	
− 0.87	
+ 0.57	From the observations of 1823.
− 0.33	
+ 0.50	
+ 0.50	
Mean = − 0.15	

Thus it seems, that the time taken by the pole star to pass over any two adjoining wires of the instrument, is *less* when the instrument is exposed to the sun's rays, than when it is defended from them, by 0.15 of a second; which, when quadrupled, and referred to the sun's mean polar distance, is less than two hundredths of a second of time.

The quantity is nearly insensible; and considering that an exposure at least ten times as great, as the instrument receives during an ordinary observation of the sun's transit, was required to produce it, I am led to the conclusion, "that the discordances between the *observed* and *computed* right ascensions of the Sun, as determined by the Blackman-street observations of 1821 and 1822, did *not* arise, from instrumental derangement."

But it may be urged that, although the experiments here narrated, prove that the differences between the sun's observed and computed right ascensions, cannot have arisen from derangement of the instrument employed in obtaining them, still there may be some peculiarity in the eye, or the judgement of the observer, which, if it exist at all, will exist as well in the observations made during exposure, as in those made, when the instrument was defended. This is a point which must be cleared up. If the differences really be as great, as my observations make them, it is fair to expect they cannot have escaped detection, in other observatories. As being easily accessible, and better known in this country than any other, let us appeal to the corresponding observations, at the Royal Observatory of Greenwich, the Royal Observatory of Paris, and the Dublin Observatory.

Our Astronomer Royal, having very obligingly transmitted me a copy of such corresponding observations, as were procured at Greenwich, the comparison with the Blackman-street determinations, is extremely easy, the same mean right ascensions of the standard stars, as also the same corrections, having been used at the two stations.

The Paris and Dublin results, will require reductions to

render them comparable with the observations of Blackman-street, and Greenwich; Mons[r]. BOUVARD having, however, kindly annexed to the Paris observations, the names of the stars used each day, in determining the clock's error, and having also put me in possession of the catalogue used at the Paris observatory, to find equations, by which each observation might be expressed in terms of the Greenwich catalogue, became only a matter of calculation.

Dr. BRINKLEY having likewise been equally indulgent, the Dublin observations are, by similar treatment, available to my purpose.

Tables XII. and XIII. contain the sun's right ascension computed for the meridian of Paris, on such days as the sun's transit was observed at the Paris, and Blackman-street observatories, during 1821 and 1822; whilst Tables XIV. and XV. answer the same purpose for the meridian of Dublin. The longitude of the former, being assumed as $9^{min.}$ $21^{sec.}$ of time east; whilst that of the latter is regarded as $25^{min.}$ $22^{sec.}$ of time, west of the Royal Observatory at Greenwich.

Tables XVI. and XVII. exhibit the sun's right ascension, as observed at Paris, by the Paris Catalogue, in values of the Greenwich Catalogue; and Tables XVIII. and XIX. serve the like purpose to the Dublin observations, reduced by the Dublin Catalogue.

Tables XX. and XXI. show the differences between the sun's observed and computed right ascensions, by Greenwich observations of 1821 and 1822.

Tables XXII. and XXIII. indicate the differences by Paris observations; and Tables XXIV. and XXV. exhibit the discordances by Dublin observations.

Table XX. shows us, that the mean of 31 observations made at Greenwich in 1821, gave the observed right ascension of the sun, greater than his computed right ascension, 0.627 of a second of time.

And Table XXI. informs us, that by the mean of 45 observations, made at Greenwich in 1822, the observed right ascension, was found greater than the computed, 0.420 of a second.

Table XXII. presents us with the mean of 16 observations of the sun, made at the Royal Observatory of Paris in 1821, whereby his observed right ascension, exceeds his computed right ascension, 0.584 of a second.

And Table XXIII. indicates, that by 28 observations made at the Paris Observatory in 1822, the observed right ascension, was found greater than the computed right ascension, 0.558 of a second.

Table XXIV. offers to our notice, 9 observations of the sun, made in the year 1821, at Dublin ; whereby the observed right ascension, was determined to be greater than the computed, 0.666 of a second.

And Table XXV. exhibits 15 observations made in 1822, at the Observatory of Dublin, giving the observed right ascension of the sun, greater than his computed, by 0.686 of a second of time.

The two following Tables will facilitate the comparison of the results, as obtained at the respective observatories.

Table exhibiting the Discordances between the Sun's observed and computed Right Ascensions, as determined at the Observatories of Blackman-street, Greenwich, Paris, and Dublin.

1821.

		Blackman-street.	Greenwich.	Paris.	Dublin.
		seconds.	seconds.	seconds.	seconds.
June	30	+ 0.834	+ 0.780	....	+ 0.939
July	9	0.926	0.830	....	....
	12	0.805	0 690	....	0.864
	18	1.062	0.770	+ 0.275	....
	19	0.978	0.580	0.532	0.811
August	3	0.756	0.670	....	....
	4	0.654	0.470	....	....
	10	0.897	0.770	....	....
	11	0.771	0.470	....	....
	17	0.594	0.830	....	....
	20	0.990	0.660	0.674	....
	21	0.733	0.940	0 411	....
	22	0.755	0.720	0.688	....
	23	0.753	0.450	0.916	0.662
	24	0.679	0.570	0.822	0.869
September	2	0.661	0.840	0.812	....
	3	0.672	0.690	....	....
	4	0.661	0.650	0.648	....
	5	0.660	0.350	0.667	....
	12	0.803	....	....	....
	15	0.681	0.570	....	....
	16	0.808	....	....	....
	24	0.773	....	....	....
	25	0.701	....	....	....
October	2	0.795	0.550	0.415	0.357
	21	0.729	0.890	0.918	....
	22	0.640	0.670	....	....
	29	0.529	0.410	0.445	0.501
	30	0.608	0.640	0.330	....
November	6	0.566	0.610	0.366	....
December	2	0.576	....	....	....
	4	0.623	0.610	+ 0.417	....
	5	0.423	0.090	....	....
	6	0.564	0.900	....	0.569
	8	0.453	0.370	....	....
	11	+ 0.503	+ 0.380	....	+ 0.419

Table exhibiting the Discordances, between the Sun's observed and computed Right Ascensions, as determined at the Observatories of Blackman-street, Greenwich, Paris, and Dublin.

1822.

	Blackman-street.	Greenwich.	Paris.	Dublin.
	seconds.	seconds.	seconds.	seconds.
January 15	+ 0.476	+ 0.180	+ 0.072	....
16	0.500	0.440	....	....
February 21	0.603	0.340	0.637	....
23	0.379	0.230	0.370	....
24	0.579	0.000	....	....
28	0.225	+ 0.150	0.610	....
March 1	0.030	— 0.100	0.436	....
April 30	0.715	+ 0.300	0.173	....
May 1	0.705	0.230	0.466	+ 0.672
21	0.861	0.790	0.490	0.913
22	0.932	0.590	1.084	0.865
24	0.597	0.550	....	0.777
27	0.983	0.670	....	....
31	0.971	0.330	0.771	....
June 1	0.826	0.480	0.233	0.630
2	0.826	0.570	0.627	....
3	0.873	0.430	0.819	0.806
4	0.704	0.460	0.631	....
6	0.927	0.680	0.606	1.007
7	0.705	0.320	1.137	0.727
22	0.694	0.570	....	0.752
July 4	0.879	....	0.605	....
7	1.095	0.700	....	....
10	0.974	....	1.081	....
31	0.889	0.430	....	....
August 1	0.670	0.310	0.972	....
2	0.812	0.570	0.868	0.722
3	0.736	0.820	....	....
4	0.697	0.600	....	....
8	0.834	0.420	....	....
9	0.864	....	....	....
17	0.665	0.460	0.384	....
18	0.743	0.420	0.351	....
19	0.563	0.150	....	0.535
21	0.576	0.540	....	0.372
October 14	0.633	....	....	....
November 4	0.430	0.320	....	....
9	0.367	0.000	....	....
13	0.342	0.310	....	....
14	0.432	0.320	....	0.301
26	0.305	....	0.412	....
29	0.467	0.480	....	....
December 6	0.543	0.540	0.383	....
7	0.525	0.470	0.667	0.658
8	0.395	0.590	....	....
22	0.164	0.370	0.121	....
23	0.158	0.280	....	....
26	0.372	0.410	0.159	+ 0.552
28	0.279	0.390	+ 0.447	....
30	+ 0.492	+ 0.800	....	....

Hence we find for 1821,

That 31 observations made in Blackman-street, gave the sun's observed right ascension, greater than the computed, - - - - -	seconds. 0.708
And by 31 correspondent observations at the Royal Observatory of Greenwich, the observed right ascension, was found greater than the computed,	0.627
That 16 observations made in Blackman-street, gave the sun's observed right ascension, greater than the computed, - - - - - -	0.736
And that 16 observations on corresponding days, made at the Royal Observatory of Paris, determined the observed right ascension, to exceed the computed, - - - - - - -	0.584
That 9 observations made in Blackman-street, found the sun's observed right ascension, greater than his computed right ascension, - - -	0.716
And that 9 correspondent observations made at Dublin, found the observed right ascension, greater than the computed, - - -	0.666

And during 1822,

That 45 observations made in Blackman-street, determined the sun's observed right ascension, to be greater than the computed, - - -	seconds. 0.608
And that 45 observations made at the Royal Observatory at Greenwich, on corresponding days, gave the observed right ascension, greater than the computed by, - - - - -	0.420

	seconds.
That 28 observations made at the Observatory in Blackman-street, found the observed right ascension, to exceed the computed, - - -	0.632
And that by 28 corresponding observations at the Royal Observatory of Paris, the observed right ascension, was determined to be greater than the computed, - - - - - -	0.558
That by 15 observations in Blackman-street, the observed right ascension, was found greater than the computed, by - - - -	0.693
And that 15 correspondent observations made at the Observatory of Dublin, the observed right ascension, exceeded the computed, by - -	0.686

Seeing therefore that results not materially differing from the Blackman-street determinations, are derived from the Greenwich, the Paris, and the Dublin observations, it is reasonable to conclude, that the discordances between the observed and computed right ascensions of the sun, as found by the Blackman-street observations, did not arise from any peculiarity in the eye, or judgement of the individual employed, in obtaining them.

We have however hinted in a former part of this memoir, that the differences as determined in Blackman-street, were not constant; and by reference to the preceding tables, discordances amongst them, to an amount far greater than can be attributed to erroneous observation, will readily be detected; hence, an investigation into their nature, becomes desirable; this, however, would lead us into an inquiry beyond the purport of the present communication; which, besides a

brief description of an admirable instrument, was intended chiefly to show, " that the discordances between the *observed* and *computed* Right Ascensions of the Sun, as determined at the Blackman-street Observatory, in the years 1821 and 1822, did *not* originate, in *instrumental* inaccuracy."

I hope however ere long to show, to the satisfaction of the Society, that the source of the discordances, must be sought for, in the imperfections of the Solar Tables.

JAMES SOUTH.

Sloane-street, N°. 132.
May 24, 1826.

Table I.

To show the Differences which exist, between the Sun's observed daily motion in Right Ascension, and his computed daily motion in Right Ascension; (by Blackman-street observations.)

1821.

		Sun's observed Right Ascension.	Observed daily motion in R. A.	Computed daily motion in R. A.	Diff. of the observed and comp^{d}.
		h. m. s.	m. s.	m. s.	s.
July	18	7 49 40.623	4 0.916	4 1.000	−0.084
	19	7 53 41.539			
August	3	8 52 49.015	3 51.598	3 51.700	−0.102
	4	8 56 40.613			
	10	9 19 38.255	3 47.274	3 47.400	−0.126
	11	9 23 25.529			
	20	9 57 8.647	3 42.143	3 42.400	−0.257
	21	10 0 50.790			
	—	10 0 50.790	3 41.921	3 41.900	+0.021
	22	10 4 32.711			
	—	10 4 32.711	3 41.398	3 41.400	−0.002
	23	10 8 14.109			
	—	10 8 14.109	3 41.026	3 41.100	−0.074
	24	10 11 55.135			
September	2	10 44 47.316	3 37.411	3 37.400	+0.011
	3	10 48 24.727			
	—	10 48 24.727	3 37.189	3 37.200	−0.011
	4	10 52 1.916			
	—	10 52 1.916	3 36.899	3 36.900	−0.001
	5	10 55 38.815			
	15	11 31 37.636	3 35.527	3 35.400	+0.127
	16	11 35 13.163			
	24	12 3 57.928	3 36.028	3 36.100	−0.072
	25	12 7 33.956			
October	21	13 43 7.287	3 47.511	3 47.600	−0.089
	22	13 46 54.798			
	29	14 13 47.288	3 53.380	3 53.300	+0 080
	30	14 17 40.668			
December	4	16 42 19.690	4 21.200	4 21.400	−0.200
	5	16 46 40.890			
	—	16 46 40.890	4 21.941	4 21.800	+0.141
	6	16 51 2.831			
				Mean =	−0.040

Table II.

To show the Differences which exist, between the Sun's observed daily motion in Right Ascension, and his computed daily motion in Right Ascension; (by Blackman-street observations.)

1822.

		Sun's observed Right Ascension.	Observed daily motion in R. A.	Computed daily motion in R. A.	Diff. of the observed and comp^{d}.
		h. m. s.	m. s.	m. s.	s.
January	15	19 47 13.042			
	16	19 51 30.565	4 17.523	4 17.500	+ 0.023
February	23	22 24 59.537			
	24	22 28 47.637	3 48.100	3 47.900	+ 0.200
	28	22 43 52.682			
March	1	22 47 37.387	3 44.705	3 44.900	— 0.195
April	30	2 28 32.973			
May	1	2 32 21.363	3 48.390	3 48.400	— 0.010
	31	4 30 53.633			
June	1	4 34 58.588	4 4.955	4 5.100	— 0.145
	—	4 34 58.588			
	2	4 39 3.989	4 5.401	4 5.400	+ 0.001
	—	4 39 3.989			
	3	4 43 9.936	4 5.947	4 5.900	+ 0.047
	—	4 43 9.936			
	4	4 47 15.967	4 6.031	4 6.200	— 0.169
	6	4 55 29.590			
	7	4 59 36.668	4 7.078	4 7.300	— 0.222
August	1	8 44 8.529			
	2	8 48 1.571	3 53.042	3 52.900	+ 0.142
	—	8 48 1.571			
	3	8 51 53.795	3 52.224	3 52.300	— 0.076
	—	8 51 53.795			
	4	8 55 45.556	3 51.761	3 51.800	— 0.039
	8	9 11 6.692			
	9	9 14 55.522	3 48.830	3 48.800	+ 0.030
	17	9 45 6.422			
	18	9 48 50.500	3 44.078	3 44.000	+ 0.078
	—	9 48 50.500			
	19	9 52 33.820	3 43.320	3 43.500	— 0.180
November	13	15 12 33.205			
	14	15 16 38.895	4 5.690	4 5.600	+ 0.090
December	6	16 49 59.310			
	7	16 54 21.592	4 22.282	4 22.300	— 0.018
	—	16 54 21.592			
	8	16 58 44.362	4 22.770	4 22.900	— 0.130
	22	18 0 41.032			
	23	18 5 7.626	4 26.594	4 26.600	— 0.006
				Mean =	— 0.030

Table III.

To reduce the Sun's Right Ascension, computed for the meridian of Greenwich, to the meridian of Blackman-street.

1821.

	Sun's R. A. computed for the meridian of Greenwich.	Computed daily motion in R. A.	Correction for diff. of long.	Sun's R. A. computed for the meridian of Blackman-street Observatory.
	h. m. s.	m. s.	sec.	h. m. s.
June 30	6 36 3.500	4 8.5	+ 0.063	6 36 3.563
July 9	7 13 8.400	4 5.3	0.062	7 13 8.462
12	7 25 23.000	4 4.0	0.062	7 25 23.062
18	7 49 39.500	4 1.0	0.061	7 49 39.561
19	7 53 40.500	4 0.5	0.061	7 53 40.561
August 3	8 52 48.200	3 51.7	0.059	8 52 48.259
4	8 56 39.900	3 51.1	0.059	8 56 39.959
10	9 19 37.300	3 47.4	0.058	9 19 37.358
11	9 23 24.700	3 46.9	0.058	9 23 24.758
17	9 45 57.900	3 43.7	0.057	9 45 57.957
20	9 57 7.600	3 42.4	0.057	9 57 7.657
21	10 0 50.000	3 41.9	0.057	10 0 50.057
22	10 4 31.900	3 41.4	0.056	10 4 31.956
23	10 8 13.300	3 41.1	0.056	10 8 13.356
24	10 11 54.400	3 40.6	0.056	10 11 54.456
September 2	10 44 46.600	3 37.4	0.055	10 44 46.655
3	10 48 24.000	3 37.2	0.055	10 48 24.055
4	10 52 1.200	3 36.9	0.055	10 52 1.255
5	10 55 38.100	3 36.7	0.055	10 55 38.155
12	11 20 50.600	3 35.5	0.055	11 20 50.655
15	11 31 36.900	3 35.4	0.055	11 31 36.955
16	11 35 12.300	3 35.4	0.055	11 35 12.355
24	12 3 57.100	3 36.1	0.055	12 3 57.155
25	12 7 33.200	3 36.3	0.055	12 7 33.255
October 2	12 32 51.600	3 38.0	0.056	12 32 51.656
21	13 43 6.500	3 47.6	0.058	13 43 6.558
22	13 46 54.100	3 48.1	0.058	13 46 54.158
29	14 13 46.700	3 53.3	0.059	14 13 46.759
30	14 17 40.000	3 54.1	0.060	14 17 40.060
November 6	14 45 15.200	3 59.7	0.061	14 45 15.261
December 2	16 33 38.000	4 20.2	0.066	16 33 38.066
4	16 42 19.000	4 21.4	0.067	16 42 19.067
5	16 46 40.400	4 21.8	0.067	16 46 40.467
6	16 51 2.200	4 22.4	0.067	16 51 2.267
8	16 59 47.500	4 23.3	0.067	16 59 47.567
11	17 12 58.800	4 24.5	+ 0.067	17 12 58.867

Note. In computing these corrections, it seems, that I used 22 seconds, in lieu of 21.76, as the longitude of my observatory; the consequence is immaterial.

Sloane Street, July 22d, 1826.

Table IV.

To reduce the Sun's Right Ascension, computed for the meridian of Greenwich, to the meridian of Blackman-street.

1822.

		Sun's R. A. computed for the meridian of Greenwich.	Computed daily motion in R. A.	Correction for diff. of long.	Sun's R. A. computed for the meridian of Blackman-street Observatory.
		h. m. s.	m. s.	s.	h. m. s.
January	15	19 47 12.500	4 17.5	+ 0.066	19 47 12.566
	16	19 51 30.000	4 16.9	0.065	19 51 30.065
February	21	22 17 21.500	3 49.1	0.058	22 17 21.558
	23	22 24 59.100	3 47.9	0.058	22 24 59.158
	24	22 28 47.000	3 47.2	0.058	22 28 47.058
	28	22 43 52.400	3 44.9	0.057	22 43 52.457
March	1	22 47 37.300	3 44.3	0.057	22 47 37.357
April	30	2 28 32.200	3 48.4	0.058	2 28 32.258
May	1	2 32 20.600	3 48.8	0.058	2 32 20.658
	21	3 50 26.700	4 0.3	0.061	3 50 26.761
	22	3 54 27.100	4 0.9	0.061	3 54 27.161
	24	4 2 29.500	4 1.9	0.062	4 2 29.562
	27	4 14 36.600	4 3.4	0.062	4 14 36.662
	31	4 30 52.600	4 5.1	0.062	4 30 52.662
June	1	4 34 57.700	4 5.4	0.062	4 34 57.762
	2	4 39 3.100	4 5.9	0.063	4 39 3.163
	3	4 43 9.000	4 6.2	0.063	4 43 9.063
	4	4 47 15.200	4 6.5	0.063	4 47 15.263
	6	4 55 28.600	4 7.3	0.063	4 55 28.663
	7	4 59 35.900	4 7.5	0.063	4 59 35.963
	22	6 1 50.900	4 9 6	0.064	6 1 50.964
July	4	6 51 36.200	4 7.2	0.063	6 51 36.263
	7	7 3 56.800	4 6.3	0.063	7 3 56.863
	10	7 16 14.400	4 5.1	0.062	7 16 14.462
	31	8 40 14.200	3 53.6	0.059	8 40 14.259
August	1	8 44 7.800	3 52.9	0.059	8 44 7.859
	2	8 48 0.700	3 52.3	0.059	8 49 0.759
	3	8 51 53.000	3 51.8	0.059	8 51 53.059
	4	8 55 44.800	3 51.1	0.059	8 55 44.859
	8	9 11 5.800	3 48.8	0.058	9 11 5.858
	9	9 14 54.600	3 48.3	0.058	9 14 54.658
	17	9 45 5.700	3 44.0	0.057	9 45 5.757
	18	9 48 49.700	3 43.5	0.057	9 48 49.757
	19	9 52 33.200	3 43.0	0.057	9 52 33.257
	21	9 59 58.700	3 42.0	0.057	9 59 58.757
October	14	13 15 59.700	3 43.1	0.057	13 15 59.757
November	4	14 36 21.200	3 57.8	0.061	14 36 21.261
	9	14 56 19.000	4 2.1	0.062	14 56 19.062
	13	15 12 32.800	4 5.6	0.063	15 12 32.863
	14	15 16 38.400	4 6.4	0.063	15 16 38.463
	26	16 6 49.100	4 15.9	0.065	16 6 49.165
	29	16 19 38.900	4 18.1	0.066	16 19 38.966
December	6	16 49 58.700	4 22.3	0.067	16 49 58.767
	7	16 54 21.000	4 22.9	0 067	16 54 21.067
	8	16 58 43.900	4 23.4	0.067	16 58 43.967
	22	18 0 40.800	4 26.6	0.068	17 0 40.858
	23	18 5 7.400	4 26.6	0.068	18 5 7.468
	26	18 18 26.900	4 26.3	0.068	18 18 26.968
	28	18 27 19.400	4 25.9	0.068	18 27 19.468
	30	18 36 11.000	4 25.6	+ 0.068	18 36 11.068

Table V.

To show the difference between the Sun's observed and computed Right Ascensions; (by Blackman-street observations).

1821.

		Sun's R. A. observed when on the meridian of Blackman-street Observatory.	Sun's R. A. computed for the meridian of Blackman-street Observatory.	Diff. of the observed and comp. R. A.	
		h. m. s.	h. m. s.	s	
June	30	6 36 4.397	6 36 3.563	+ 0.834	During these observations, the instrument was defended from the sun's rays, till his first limb had nearly reached, the first wire.
July	9	7 13 9.388	7 13 8.462	0.926	
	12	7 25 23.867	7 25 23.062	0.805	
	18	7 49 40.623	7 49 39.561	1.062	
	19	7 53 41.539	7 53 40.561	0.978	
August	3	8 52 49.015	8 52 48.259	0.756	
	4	8 56 40.613	8 56 39.959	0.654	
	10	9 19 38.255	9 19 37.358	0.897	
	11	9 23 25.529	9 23 24.758	0.771	
	17	9 45 58.551	9 45 57.957	0.594	
	20	9 57 8.647	9 57 7.657	0.990	
	21	10 0 50.790	10 0 50.057	0.733	
	22	10 4 32.711	10 4 31.956	0.755	exposed
	23	10 8 14.109	10 8 13.356	0.753	exposed
	24	10 11 55.135	10 11 54.456	0.679	exposed
September	2	10 44 47.316	10 44 46.655	0.661	defended
	3	10 48 24.727	10 48 24.055	0.672	exposed
	4	10 52 1.916	10 52 1.255	0.661	defended
	5	10 55 38.815	10 55 38.155	0.660	exposed
	12	11 20 51.458	11 20 50.655	0.803	defended
	15	11 31 37.636	11 31 36.955	0.681	defended
	16	11 35 13.163	11 35 12.355	0.808	defended
	24	12 3 57.928	12 3 57.155	0.773	defended
	25	12 7 33.956	12 7 33.255	0.701	exposed
October	2	12 32 52.451	12 32 51.656	0.795	defended
	21	13 43 7.287	13 43 6.558	0.729	exposed
	22	13 46 54.798	13 46 54.158	0.640	exposed
	29	14 13 47.288	14 13 46.759	0.529	defended
	30	14 17 40.668	14 17 40.060	0.608	defended
November	6	14 45 15.827	14 45 15.261	0.566	defended
December	2	16 33 38.642	16 33 38.066	0.576	defended
	4	16 42 19.690	16 42 19.067	0.623	defended
	5	16 46 40.890	16 46 40.467	0.423	defended
	6	16 51 2.831	16 51 2.267	0.564	defended
	8	16 59 48.020	16 59 47.567	0.453	defended
	11	17 12 59.370	17 12 58.867	+ 0.503	defended
			Mean by 36 obs, =	+ 0.712	

Note; wherever the word "defended" is annexed to the column of differences, in this, and the following tables, it means, that every part of the instrument, except the object-glass, was entirely excluded from the sun's rays, during the day of observation; as were also the side plates and stone piers.

Table VI.

To show the Differences between the Sun's observed and computed Right Ascensions; (by Blackman-street observations).

1822.

		Sun's R. A. when obsd on the meridian of the Blackman-st. Observy.	Sun's R. A. computed for the meridiau of Blackman-street.	Diff. of the observed and computed R. A.	
		h. m. s.	h. m. s.	s.	
January	15	19 47 13.042	19 47 12.566	+ 0.476	defended
	16	19 51 30.565	19 51 30.065	0.500	defended
February	21	22 17 22.161	22 17 21.558	0.603	defended
	23	22 24 59.537	22 24 59.158	0.379	defended
	24	22 28 47.637	22 28 47.058	0.579	defended
	28	22 43 52.682	22 43 52.457	0.225	defended
March	1	22 47 37.387	22 47 37.357	0.030	exposed
April	30	2 28 32.973	2 28 32.258	0.715	defended
May	1	2 32 21.363	2 32 20.658	0.705	defended
	21	3 50 27.622	3 50 26.761	0.861	exposed
	22	3 54 28.093	3 54 27.161	0.932	defended
	24	4 2 30.159	4 2 29.562	0.597	defended
	27	4 14 37.645	4 14 36.662	0.983	defended
	31	4 30 53.633	4 30 52.662	0.971	exposed
June	1	4 34 58.588	4 34 57.762	0.826	defended
	2	4 39 3.989	4 39 3.163	0.826	exposed
	3	4 43 9.936	4 43 9.063	0.873	defended
	4	4 47 15.967	4 47 15.263	0.704	exposed
	6	4 55 29.590	4 55 28.663	0.927	defended
	7	4 59 36.668	4 59 35.963	0.705	exposed
	22	6 1 51.658	6 1 50.964	0.694	exposed
July	4	6 51 37.142	6 51 36.263	0.879	defended
	7	7 3 57.958	7 3 56.863	1.095	defended
	10	7 16 15.436	7 16 14.462	0.974	defended
	31	8 40 15.148	8 40 14.259	0.889	defended
August	1	8 44 8.529	8 44 7.859	0.670	defended
	2	8 48 1.571	8 48 0.759	0.812	defended
	3	8 51 53.795	8 51 53.059	0.736	defended
	4	8 55 45.556	8 55 44.859	0.697	defended
	8	9 11 6.692	9 11 5.858	0.834	defended
	9	9 14 55.522	9 14 54.658	0.864	defended
	17	9 45 6.422	9 45 5.757	0.665	defended
	18	9 48 50.500	9 48 49.757	0.743	defended
	19	9 52 33.820	9 52 33.257	0.563	defended
	21	9 59 59.333	9 59 58.757	0.576	defended
October	14	13 16 0.390	13 16 59.757	0.633	defended
November	4	14 36 21.691	14 36 21.261	0.430	defended
	9	14 56 19.429	14 56 19.062	0.367	defended
	13	15 12 33.205	15 12 32.863	0.342	defended
	14	15 16 38.895	15 16 38.463	0.432	defended
	26	16 6 49.470	16 6 49.165	0.305	defended
	29	16 19 39.433	16 19 38.966	0.467	defended
December	6	16 49 59.310	16 49 58.767	0.543	defended
	7	16 54 21.592	16 54 21.067	0.525	defended
	8	16 58 44.362	16 58 43.967	0.395	defended
	22	18 0 41.032	18 0 40.868	0.164	exposed
	23	18 5 7.626	18 5 7.468	0.158	defended
	26	18 18 27.340	18 18 26.968	0.372	defended
	28	18 27 19.747	18 27 19.468	0.279	defended
	30	18 36 11.560	18 36 11.068	+ 0.492	defended

Mean by 50 obs. = + 0.620

Table VII.

To show the nature and extent of the exposure, to which the Instrument was subjected.

1821.

Exposure of the Instrument, August 22.

The Sun's rays were allowed to fall upon the Instrument, eighteen minutes before his centre came to the meridian ; not a cloud intervened, during the interval of exposure ; no thermometers were appealed to.

Exposure of the Instrument, August 23.

Times of Comparison. h. m.	Thermometers on the Western Axis.	Thermometers on the Eastern Axis.
9 46	69°.0	69°.0
9 54	83 .9	70 .3
9 57	85 .0	71 .0
10 0	85 .6	71 .0
10 5	85 .6	71 .2
10 10	88 .0	72 .0
	Mean = 85 .6	Mean = 71 .1

Hence, difference of temperature = 14°.5.

Exposure of the Instrument, August 24.

Times of Comparison. h. m.	Thermometers on the Western Axis.	Thermometers on the Eastern Axis.
9 8	70°.0	70°.1
9 18	79 .2	71 .8
9 24	83 .0	71 .8
9 29	84 .5	71 .9
9 33	85 .0	71 .9
9 38	85 .9	71 .9
	Mean = 83 .5	Mean = 71 .9

Hence, difference of temperature = 11°.6.

Table VII.—*continued.*

The bulbs of the thermometers, were now placed under the covers* of each axis and brace, and the results were as follow.

Times of Comparison h. m	Thermometers on the Western Axis.	Thermometers on the Eastern Axis.
9 57	88°.0	72°.0
10 1	90 .0	72 .1
10 6	93 .0	72 .3
10 13	95 .8	72 .5
	Mean = 91 .7	Mean = 72 .2

Hence, difference of temperature = 19°.5.

Thermometers under the covers of the braces, afforded results nearly the same as the above. Not a cloud passed over the sun, during the experiments.

Exposure of the Instrument, September 3.

Times of Comparison. h. m.	Thermometer on the Western Axis.	Thermometer on the Eastern Axis.
10 33	80°.0	69°8.
10 36	83 .2	70 .4
10 39	84 .6	71 .0
10 42	84 .8	72 .1
	Mean = 83 .1	Mean = 70 .8

Hence, difference of temperature = 13°.7.

Note.—The instrument during this day's experiments, was deprived of all its coverings. The exposure commenced at 9^h 43′ sidereal time, but no comparison of the thermometers was made, until 10^h 33′.

Exposure of the Instrument, September 5.

To procure more decisive differences of temperature, between the western brace and axis, and those on the eastern side of the instrument, the former, were now enveloped in black woollen cloth, the latter, in white; the western half also of the centre piece, was covered with *black*, whilst the eastern half of it was enclosed, in *white* cloth; the telescope tubes, however,

* Vide page 14.

Table VII.—*continued.*

were still included in their ordinary coverings, of green cloth.* These arrangements were persevered in, during all future observations; the different portions were well fitted to the figure of the instrument, and not being unseemly, were constantly retained in sitû.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
9 45	68°.0	68°.0
10 1	78 .0	69 .8
10 7	81 .8	70 .3
10 10	82 .2	70 .6
10 13	84 .5	70 .8
10 21	84 .0	70 .8
10 30	85 .5	71 .5
10 35	84 .0	71 .8
10 38	84 .0	71 .8
10 45	87 .0	72 .2
10 49	89 .0	72 .5
10 51	90 .0	72 .4
	Mean = 84 .5	Mean = 71 .3

Hence, difference of temperature = 13°.2.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Brace.	Thermometers under the cover of the White, or Eastern Brace.
9 45	68°.0	68°.0
10 23	84 .0	71 .0
10 25	84 .5	72 .0
10 30	85 .5	72 .0
10 35	85 .5	72 .0
10 40	86 .0	71 .0
10 45	86 .0	73 .0
10 49	88 .0	73 .0
10 51	89 .5	73 .0
	Mean = 86 .1	Mean = 72 .1

Hence, difference of temperature = 14°.0.

During these experiments not a cloud had been visible.

* Vide page 14.

Table VII.—*continued.*

Exposure of the Instrument, September 25.

The Sun's rays were allowed to fall upon the instrument, sixty-three minutes before his centre came to the meridian; other observations prevented me, attending to the thermometers; the sky cloudless.

Exposure of the Instrument, October 21.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
12 56	50°.0	50°.0
13 9	59 .0	51 .5
13 10	60 .5	51 .5
13 12	62 .0	51 .7
13 19	65 .0	52 .0
13 23	67 .0	52 .2
13 27	69 .0	52 .5
13 45	70 .0	53 .5
	Mean = 64 .6	Mean = 52 .1

Hence, difference of temperature = 12°.5.

Thermometers placed under the covers of the black and white braces, did not vary half a degree, from those applied to the cones of the axis. During the observations, not a cloud was visible.

Exposure of the Instrument, October 22.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
12 56	51°.0.	51°.0
13 6	64 .0	52 .5
13 12	65 .0	53 .0
13 18	67 .0	53 .5
13 20	68 .5	53 .8
13 22	71 .0	54 .0
13 24	73 .8	54 .0
13 26	74 .5	54 .1
13 46	76 .0	54 .8
	Mean = 70 .0	Mean = 53 .7

Hence, difference of temperature = 16°.3.

Thermometers under the covers of the black, and white braces, afforded results differing from the above, only a small fraction of a degree.

Table VII.—*continued.*

1822.

Exposure of the Instrument, March 1.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
21 33	41°.0	41°.0
22 10	58 .0	44 .0
22 27	68 .5	44 .5
22 40	68 .0	44 .5
22 49	68 .5	45 .5
	Mean = 65 .8	Mean = 44 .6

Hence, difference of temperature = 21°.2.

Not a cloud was visible, from the time at which the shutter was opened, until the experiments were concluded.

Exposure of the Instrument, May 21.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Brace.	Thermometers under the cover of the White, or Eastern Brace.
2 47	66°.3	66°.3
3 22	89 .0	72 .0
3 45	91 .0	74 .0
3 53	94 .0	74 .0
	Mean = 91 .3	Mean = 73 .3

Hence, difference of temperature = 18°.0.

Thermometers under the covers of the western and eastern axes, gave results similar to these. Sky cloudless.

Exposure of the Instrument, May 31.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
3 20	60°.0	60°.0
3 55	80 .0	62 .0
4 10	84 .0	63 .0
4 20	86 .0	63 .0
4 33	90 .0	64 .0
	Mean = 85 .0	Mean = 63 .0

Hence, difference of temperature = 22°.0.

A cloudless sky, during the observations. Thermometers under the covers of the braces, gave results coincident with the above.

Table VII.—*continued.*

Exposure of the Instrument, June 2.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
3 30	67°.5	67°.8
4 0	80 .0	70 .0
4 5	86 .0	71 .0
4 15	95 .0	73 .0
4 28	96 .0	74 .0
4 34	98 .0	74 .5
4 42	100 .5	75 .0
	Mean = 92 .6	Mean = 72 .9

Hence, difference of temperature = 19°.7.

Thermometers under the covers of the braces, afforded results similar with the above. Not a cloud passed over the Sun, during the time the instrument was exposed to his rays. Thermometers placed *immediately over* the black axis, never indicated a temperature exceeding 94°.

Exposure of the Instrument, June 4.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
3 50	68°.5	68°.3
4 25	96 .0	71 .0
4 35	98 .0	72 .0
4 40	100 .0	74 .0
4 45	104 .0	76 .0
4 50	107 .0	76 .0
	Mean = 101 .0	Mean = 73 .8

Hence, difference of temperature = 27°.2.

Thermometers placed under the covers of the braces, do not differ one degree from the above. A cloudless sky.

Table VII.—*continued.*

Exposure of the Instrument, June 7.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Brace.	Thermometers under the cover of the White, or Eastern Brace.
3 50	62°.0	62°.0
4 20	90 .0	64 .0
4 30	96 .0	65 .0
4 50	100 .0	68 .0
5 2	108 .0	74 .0
	Mean = 98 .5	Mean = 67 .8

Hence, difference of temperature = 30°.7.

Not a cloud visible, during the exposure of the instrument. Thermometers under the covers of the axis, gave results similar to the above.

Exposure of the Instrument, June 22.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
5 0	61°.3	61°.5
5 20	88 .0	64 .0
5 30	90 .0	64 .0
5 45	92 .0	66 .0
5 53	94 .0	68 .0
6 4	98 .0	71 .0
	Mean = 92 .4	Mean = 66 .6

Hence, difference of temperature = 25°.8.

Exposure of the Instrument, December 22.

The Sun's rays, were allowed to fall upon the instrument, half an hour before noon, at which time, the thermometers on the western and eastern axes, stood at 53°.0 and 31°.0.

Hence, difference of temperature = 22°.0.

Table VIII.

To show the Transits of the Pole Star, and the nature of the exposure to which the Instrument was subjected.

1821.

Observed Transits of the Pole Star.

	m. s.	m. s.	h. m. s.	m. s.	m. s.	
	A	B	C	D	E	
October 20	28 40.0	43 1.5	0 57 20.0	11 39.5	26 1.5	Polaris.
	E	D	C	B	A	
21	28 38.0	43 0.0	12 57 19.0	11 35.0	25 55.0	Polaris *s p.* (trem[s].)
	E	D	C	B	A	
22	28 34.0	42 58.5	12 57 17.5	11 35.5	25 55.0	Polaris *s p.*
	A	B	C	D	E	
22	28 42.0	43 3.0	0 57 20.5	11 38.0	26 2.0	Polaris.
	E	D	C	B	A	
24	28 34.5	42 55.0	12 57 14.0	11 29.5	......	Polaris *s p.*

On the 21st and 22nd, the Sun's rays were allowed to fall upon the instrument, immediately after the star, at its *sub* polar transit, had passed the wire C, until its transits over the wires B and A, were procured.

With these exceptions, the instrument was entirely defended, from the influence of the solar rays.

Exposure of the Instrument, October 21.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
12 56	50°.0	50°.0
13 9	59 .0	51 .5
13 10	60 .5	51 .5
13 12	62 .0	51 .7
13 19	65 .0	52 .0
13 23	67 .0	52 .2
13 26.30	69 .0	52 .5
	Mean = 63 .7	Mean = 51 .9

Hence, difference of temperature = 11°.8.

Thermometers placed under the covers of the black and white braces, did not differ with those applied to the axes, half a degree.

During the observations not a cloud visible.

Table VIII.—*continued.*

Exposure of the Instrument, October 22.

Times of Comparison.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
h. m.	°	°
12 56	51 .0	51 .0
13 6	64 .0	52 .5
13 12	65 .0	53 .0
13 18	67 .0	53 .5
13 20	68 .5	53 .8
13 22	71 .0	54 .0
13 24	73 .8	54 .0
13 26	74 .5	54 .1
	Mean = 69 .1	Mean = 53 .6

Hence, difference of temperature = 15°.5.

Thermometers placed under the covers of the black and white braces, gave results similar to these. An Italian sky; not a cloud to be seen.

1823.

Observed Transits of the Pole Star.

	m. s.	m. s.	h. m. s.	m. s.	m. s.	
October 9	......	D 44 11.0	C 12 58 39.0	......	......	Polaris *s p.*
10	......	D 44 14.5	C 12 58 38.0	......	......	Polaris *s p.*
11	......	D 44 15.0	C 12 58 38.0	......	......	Polaris *s p.*
11	A 29 55.5	B 44 21.5	C 0 58 46.0	D 13 11.0	E 27 38.0	Polaris.
12	E 29 43.5	......	....	B 12 59.5	......	Polaris *s p.*
13	A 29 56.0	B 44 21.0	C 0 58 46.0	D 13 13.0	E 27 40.5	Polaris.
15	A 29 53.0	B 44 23.0	C 0 58 47.0	D 13 10.0	E 27 38.0	Polaris.
16	E 29 45.0	D 44 13.0	C 12 58 38.5	......	......	Polaris *s p.*
*16	A 29 56.0	B 44 23.0	C 0 58 44.5	D 13 12.0	......	Polaris.

On the 9th and 10th, the Sun's rays were allowed to fall upon the instrument, after the star at its *sub*-polar transit, had passed the wire D.

On the 12th and 16th, the instrument was exposed to the Sun, after that the star at its *sub*-polar transit, had traversed the wire E.

With these exceptions, the instrument was *entirely defended*, from the Sun's rays.

* These observations (the clock's daily rate being nearly insensible), indicate slight *ex*-meridian position; and may serve as a practical illustration, of the statement made in page 12; seeing, that *seven* months have elapsed, since the instrument was moved by its azimuthal adjustment; and that nearly *seventeen* have transpired, since non-horizontality of its axis, could be detected.

Table VIII.—*continued.*

Exposure of the Instrument, October 9.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
12 43	54°.0	54°.0
12 49	69 .0	54 .7
12 51	73 0	54 .8
12 53	75 .0	55 .0
12 55	76 .0	55 .2
12 57	76 .5	55 .8
12 59	78 .0	56 .0
	Mean = 74 .6	Mean = 55 .3

Hence, difference of temperature = 19°.3.

Thermometers placed under the covers of the black and white braces, did not vary from those applied to the axes, more than half, or three-quarters of a degree. During the observations not a cloud had been visible.

Exposure of the Instrument, October 10.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
12 42	50°.0	50°.0
12 49	68 .0	51 .0
12 52	75 .0	52 .0
12 53	78 .0	52 .3
12 55	79 .0	52 .5
12 57	81 .0	53 .0
12 59	83 .0	53 .5
	Mean = 77 .3	Mean = 52 .4

Hence, difference of temperature = 24°.9.

Not a cloud visible, during the observations. Thermometers under the covers of the western and eastern braces, did not differ more than half a degree, from those applied to the axes.

Table VIII.—*continued.*

Exposure of the Instrument, October 12.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
12 28	50°.0	50°.0
12 40	68 .0	51 .5
12 50	70 .0	51 .7
12 53	73 .0	51 .8
12 57	74 .0	52 .2
13 5	74 .5	52 .5
13 10	75 .2	53 .0
13 12	75 .4	53 .2
	Mean = 72 .9	Mean = 52 .3

Hence, difference of temperature = 20°.6.

Thermometers under the covers of the western and eastern braces, did not differ from those applied to the axes, one degree.

Light clouds passing, prevented the transits over the wires D and C, being procured; and it was not deemed right to call in the aid of the micrometer wire, lest any source of error, might be suspected. Not a cloud, however, was visible, south of the zenith of the observatory during the experiments. The transits over E and B, were extremely satisfactory, the star being remarkably steady.

Exposure of the Instrument, October 16.

Times of Comparison. h. m.	Thermometers under the cover of the Black, or Western Axis.	Thermometers under the cover of the White, or Eastern Axis.
12 28	49°.0	49°.0
12 34	64 .5	50 .0
12 38	66 .5	51 .5
12 42	69 .0	51 .7
12 45	70 .0	52 .0
12 49	71 .0	52 .6
12 55	72 .5	53 .0
12 59	73 .8	53 .3
	Mean = 69 .6	Mean = 52 .0

Hence, difference of temperature = 17°.6.

Thermometers under the covers of the braces, gave results not differing from the above, one degree. Not a cloud visible, during the observations.

Table IX.

Showing the time, in which the Pole Star passed to the several wires of the Instrument, under experiments of exposure.

1821.

Date	Wires	min.	sec.
October 21.	From C to B	14	16. 0
22.		14	18. 0
	Mean =	14	17. 0
October 21.	From B to A	14	20. 0
22.		14	20. 5
	Mean =	14	20.25
October 21.	From B to E	42	57. 0
22.		43	1. 5
	Mean =	42	59.25
October 21.	From C to A	28	36. 0
22.		28	37. 5
	Mean =	28	36.75
October 21.	From B to D	28	35. 0
22.		28	37. 0
	Mean =	28	36. 0
October 21.	From A to D	42	55. 0
22.		42	56. 5
	Mean =	42	55.75
October 21.	From A to E	57	17.0
22.		57	21.0
	Mean =	57	19.0

1823.

Date	Wires	min.	sec.
October 9.	From C to D	14	28. 0
10.		14	23. 5
16.		14	25. 5
	Mean =	14	25.67
October 16.	From E to D	14	28. 0
October 12.	From B to E	43	16.0
October 16.	From E to C	28	53.5

Table X.

Showing the times in which the Pole Star passed to the several wires, when the Instrument was defended from the Sun's rays.

1821.

Date	Wires	min.	sec.
October 20.	From C to B	14	18. 5
22		14	17. 5
24		14	15. 5
	Mean =	14	17.17
October 20.	From B to A	14	21. 5
22		14	21. 0
	Mean =	14	21.25
October 20.	From B to E	43	0. 0
22		42	59. 0
24		42	55. 0
	Mean =	42	58. 0
October 20.	From A to E	57	21. 5
22		57	20. 0
	Mean =	57	20.75
October 20.	From C to A	28	40. 0
22		28	38. 5
	Mean =	28	39.25
October 20.	From B to D	28	38. 0
22		28	35. 0
24		28	34. 5
	Mean =	28	35.83
October 20.	From A to D	42	59. 5
22		42	56. 0
	Mean =	42	57.75

1823.

Date	Wires	min.	sec.
October 11.	From C to D	14	23. 0
11		14	25. 0
13		14	27. 0
15		14	23. 0
16		14	27. 5
	Mean =	14	25.10
October 11.	From E to D	14	27. 0
13		14	27. 5
15		14	28. 0
	Mean =	14	27.50
October 11.	From B to E	43	16. 5
13		43	19. 5
15		43	15. 0
	Mean =	43	17.00
October 11.	From E to C	28	52. 0
13		28	54. 5
15		28	51. 0
	Mean =	28	52.50

Table XI.

Showing the differences between the intervals of time, in which the Pole Star passed to the several wires, when the instrument was exposed to, and defended from, the Sun's rays.

1821.	min.	sec.	Difference. sec.
C B (1 interval); 1 exposed =	14	17.00	— 0.17
C B defended.......... =	14	17.17	
C A (2 intervals); 2 exposed =	28	36.75	— 2.50
C A defended.......... =	28	39.25	
B A (1 interval); 1 exposed =	14	20.25	— 1.00
B A defended.......... =	14	21.25	
B D (2 intervals); 1 exposed =	28	36.00	+ 0.17
B D defended.......... =	28	35.83	
B E (3 intervals); 1 exposed =	42	59.25	+ 1.25
B E defended.......... =	42	58.00	
A D (3 intervals); 2 exposed =	42	55.75	— 2.00
A D defended.......... =	42	57.75	
A E (4 intervals); 2 exposed =	57	19.00	— 1.75
A E defended.......... =	57	20.75	

1823.	min.	sec.	Difference. sec.
C D (1 interval); 1 exposed =	14	25.67	+ 0.57
C D defended.......... =	14	25.10	
B E (3 intervals); 3 exposed =	43	16.00	— 1.00
B E defended.......... =	43	17.00	
E D (1 interval); 1 exposed =	14	28.00	+ 0.50
E D defended.......... =	14	27.50	
E C (2 intervals); 2 exposed =	28	53.50	+ 1.00
E C defended.......... =	28	52.50	

Table XII.

To reduce the Sun's Right Ascension, computed for the meridian of Greenwich, to the meridian of Paris.

1821.

	Sun's R. A. computed for the meridian of Greenwich.	Computed daily motion in R. A.	Correction for Diff. of Longit.	Sun's R. A. computed for the meridian of Paris.
	h. m. s.	m. s.	s.	h. m. s.
July 18	7 49 39.500	4 1.0	— 1.565	7 49 37.935
19	7 53 40.500	4 0.5	1.562	7 53 38.938
August 20	9 57 7.600	3 42.4	1.444	9 57 6.156
21	10 0 50.000	3 41.9	1.441	10 0 48.559
22	10 4 31.900	3 41.4	1.438	10 4 30.462
23	10 8 13.300	3 41.1	1.436	10 8 11.864
24	10 11 54.400	3 40.6	1.432	10 11 52.968
September 2	10 44 46.600	3 37.4	1.412	10 44 45.188
4	10 52 1.200	3 36.9	1.408	10 51 59.792
5	10 55 38.100	3 36.7	1.407	10 55 36.693
October 2	12 32 51.600	3 38.0	1.415	12 32 50.185
21	13 43 6.500	3 47.6	1.478	13 43 5.022
29	14 13 46.700	3 53.3	1.515	14 13 45.185
30	14 17 40.000	3 54.1	1.520	14 17 38.480
November 6	14 45 15.200	3 59.7	1.556	14 45 13.644
December 4	16 42 19.000	4 21.4	— 1.697	16 42 17.303

Table XIII.

To reduce the Sun's Right Ascension, computed for the meridian of Greenwich, to the meridian of Paris.

1822.

		Sun's R. A. computed for the meridian of Greenwich.	Computed daily motion in R. A.	Correction for Diff. of Longit.	Sun's R. A. computed for the meridian of Paris.
		h. m. s.	m. s.	s.	h. m. s.
January	15	19 47 12.500	4 17.5	— 1.672	19 47 10.828
February	21	22 17 21.500	3 49.1	1.487	22 17 20.013
	23	22 24 59.100	3 47.9	1.480	22 24 57.620
	28	22 43 52.400	3 44.9	1.460	22 43 50.940
March	1	22 47 37.300	3 44.3	1.456	22 47 35.844
April	30	2 28 32.200	3 48.4	1.483	2 28 30.717
May	1	2 32 20.600	3 48.8	1.486	2 32 29.114
	21	3 50 26.700	4 0.3	1.560	3 50 25.140
	22	3 54 27.100	4 0.9	1.564	3 54 25.536
	31	4 30 52.600	4 5.1	1.591	4 30 51.009
June	1	4 34 57.700	4 5.4	1.593	4 34 56.107
	2	4 39 3.100	4 5.9	1.597	4 39 1.503
	3	4 43 9.000	4 6.2	1.599	4 43 7.401
	4	4 47 15.200	4 6.5	1.601	4 47 13.599
	6	4 55 28.600	4 7.3	1.606	4 55 26.994
	7	4 59 35.900	4 7.5	1.607	4 59 34.293
July	4	6 51 36.200	4 7.2	1.605	6 51 34.595
	10	7 16 14.400	4 5.1	1.591	7 16 12.809
August	1	8 44 7.800	3 52.9	1.512	8 44 6.288
	2	8 48 0.700	3 52.3	1.508	8 47 59.192
	17	9 45 5.700	3 44.0	1.454	9 45 4.246
	18	9 48 49.700	3 43.5	1.451	9 48 48.249
November	26	16 6 49.100	4 15.9	1.662	16 6 47.438
December	6	16 49 58.700	4 22.3	1.703	16 49 56.997
	7	16 54 21.000	4 22.9	1.707	16 54 19.293
	22	18 0 40.800	4 26.6	1.731	18 0 39.069
	26	18 18 26.900	4 26.3	1.729	18 18 25.171
	28	18 27 19.400	4 25.9	— 1.727	18 27 17.673

Table XIV.

To reduce the Sun's Right Ascension, computed for the meridian of Greenwich, to the meridian of Dublin Observatory.

1821.

		Sun's R. A. computed for the meridian of Greenwich.	Computed daily motion in R. A.	Correction foi Diff. of Longit.	Sun's R. A. computed for the meridian of Dublin Observatory.
		h. m. s.	m. s.	s.	h. m. s.
June	30	6 36 3.500	4 8.5	+ 4.342	6 36 7.842
July	12	7 25 23.000	4 4.0	4.298	7 25 27.298
	19	7 53 40.500	4 0.5	4.237	7 53 44.737
August	23	10 8 13.300	3 41.1	3.895	10 8 17.195
	24	10 11 54.400	3 40.6	3.886	10 11 58.286
October	2	12 32 51.600	3 38.0	3.840	12 32 55.440
	29	14 13 46.700	3 53.3	4.110	14 13 50.810
December	6	16 51 2.200	4 22.4	4.622	16 51 6.822
	11	17 12 58.800	4 24.5	+ 4.659	17 13 3.459

Table XV.

To reduce the Sun's Right Ascension, computed for the meridian of Greenwich, to the meridian of Dublin Observatory.

1822.

		Sun's R. A. computed for the meridian of Greenwich.	Computed daily motion in R. A.	Correction for Diff. of Longit.	Sun's R. A. computed for the meridian of Dublin Observatory.
		h. m. s.	m. s.	s.	h. m. s.
May	1	2 32 20.600	3 48.8	+ 4.030	2 32 24.630
	21	3 50 26.700	4 0.3	4.233	3 50 30.933
	22	3 54 27.100	4 0.9	4.244	3 54 31.344
	24	4 2 29.500	4 1.9	4.261	4 2 33.761
June	1	4 34 57.700	4 5.4	4.323	4 35 2.023
	3	4 43 9.000	4 6.2	4.337	4 43 13.337
	6	4 55 28.600	4 7.3	4.356	4 55 32.956
	7	4 59 35.900	4 7.5	4.360	4 59 40.260
	22	6 1 50.900	4 9.6	4.397	6 1 55.297
August	2	8 48 0.700	3 52.3	4.092	8 48 4.792
	19	9 52 33.200	3 43.0	3.928	9 52 37.128
	21	9 59 58.700	3 42.0	3.911	10 0 2.611
November	14	15 16 38.400	4 6.4	4.340	15 16 42.740
December	7	16 54 21.000	4 22.9	4.631	16 54 25.631
	26	18 18 26.900	4 26.3	+ 4.673	18 18 31.573

Table XVI.

To convert the Sun's observed Right Ascension, reduced by the Paris Catalogue, into his correspondent Right Ascension, by the Greenwich Catalogue.

1821.

		Sun's R. A. observed at Paris, the reductions being made by the Paris Catalogue.	Equation for Diff. of Paris and Greenwich Catal.	Sun's R. A. observed at Paris, reduced by the Greenwich Catalogue.
		h. m. s.	s.	h. m. s.
July	18	7 49 37.950	+0.260	7 49 38.210
	19	7 53 39.200	0.270	7 53 39.470
August	20	9 57 6.550	0.280	9 57 6.830
	21	10 0 48.620	0.350	10 0 48.970
	22	10 4 30.830	0.320	10 4 31.150
	23	10 8 12.440	0.340	10 8 12.780
	24	10 11 53.530	0.260	10 11 53.790
September	2	10 44 45.750	0.250	10 44 46.000
	4	10 52 0.210	0.230	10 52 0.440
	5	10 55 37.080	0.280	10 55 37.360
October	2	12 32 50.280	0.320	12 32 50.600
	21	13 43 5.600	0.340	13 43 5.940
	29	14 13 45.330	0.340	14 13 45.630
	30	14 17 38.540	0.270	14 17 38.810
November	6	14 45 13.680	0.330	14 45 14.010
December	4	16 42 17.460	+0.260	16 42 17.720

Table XVII.

To convert the Sun's observed Right Ascension, reduced by the Paris Catalogue, into his correspondent Right Ascension, by the Greenwich Catalogue.

1822.

		Sun's R. A. observed at Paris, the reductions being made by Paris Catalogue.	Equation for Diff. of Paris and Greenwich Catal.	Sun's R. A. observed at Paris, reduced by the Greenwich Catalogue.
		h. m. s.	s.	h. m. s.
January	15	19 47 10.500	+ 0.400	19 47 10.900
February	21	22 17 20.310	0.340	22 17 20.650
	23	22 24 57.710	0.280	22 24 57.990
	28	22 43 51.240	0.310	22 43 51.550
March	1	22 47 35.980	0.300	22 47 36.280
April	30	2 28 30.710	0.180	2 28 30.890
May	1	2 32 19.280	0.300	2 32 19.580
	21	3 50 25.350	0.280	3 50 25.630
	22	3 54 26.230	0.390	3 54 26.620
	31	4 30 51.430	0.370	4 30 51.780
June	1	4 34 56.150	0.190	4 34 56.340
	2	4 39 1.910	0.220	4 39 2.130
	3	4 43 7.950	0.270	4 43 8.220
	4	4 47 14.030	0.200	4 47 14.230
	6	4 55 27.410	0.190	4 55 27.600
	7	4 59 35.070	0.360	4 59 35.430
July	4	6 51 34.850	0.350	6 51 35.200
	10	7 16 13.500	0.390	7 16 13.890
August	1	8 44 6.980	0.280	8 44 6.260
	2	8 47 59.730	0.340	8 48 0.060
	17	9 45 4.300	0.330	9 45 4.630
	18	9 48 48.260	0.340	9 48 48.600
November	26	16 6 47.570	0.280	16 6 47.850
December	6	16 49 57.020	0.360	16 49 57.380
	7	16 54 19.610	0.350	16 54 19.960
	22	18 0 38.910	0.280	18 0 39.190
	26	18 18 25.060	0.270	18 18 25.330
	28	18 27 17.840	+ 0.280	18 27 18.120

Table XVIII.

To convert the Sun's observed Right Ascension, reduced by the Dublin Catalogue, into his correspondent Right Ascension reduced by the Greenwich Catalogue.

1821.

	Sun's R. A. observed at Dublin, the reductions being made by the Dublin Catalogue.	Equation for Diff. of Dublin and Greenwich Cat.	Sun's R. A. observed at Dublin, reduced by the Greenwich Catalogue.
	h. m. s.	s.	h. m. s.
June 30	6 36 8.500	+ 0.281	6 36 8.781
July 12	7 25 27.880	0.282	7 25 28.162
19	7 53 45.250	0.298	7 53 45.548
August 23	10 8 17.650	0.207	10 8 17.857
24	10 11 58.860	0.295	11 11 59.155
October 2	12 32 55.590	0.207	12 32 55.797
29	14 13 51.050	0.261	14 13 51.311
December 6	16 51 7.100	0.291	16 51 7.391
11	17 13 3.590	+ 0.288	17 13 3.878

Table XIX.

To convert the Sun's observed Right Ascension, reduced by the Dublin Catalogue, into his correspondent Right Ascension, by the Greenwich Catalogue.

1822.

	Sun's R. A. observed at Dublin, the reductions being made by the Dublin Catalogue.	Equation for Diff. of Dublin and Greenwich Cat.	Sun's R. A. observed at Dublin, reduced by the Greenwich Catalogue.
	h. m. s.	s.	h. m. s.
May 1	2 32 25.030	+ 0.272	2 32 25.302
21	3 50 31.570	0.276	3 50 31.846
22	3 54 31.920	0.289	3 54 32.209
24	4 2 34.250	0.288	4 2 34.538
June 1	4 35 2.340	0.313	4 35 2.653
3	4 43 13.840	0.303	4 43 14.143
6	4 55 33.660	0.303	4 55 33.963
7	4 59 40.680	0.307	4 59 40.987
22	6 1 55.760	0.289	6 1 56.049
August 2	8 48 5.220	0.294	8 48 5.514
19	9 52 37.390	0.273	9 52 37.663
21	10 0 2.720	0.263	10 0 2.983
November 14	15 16 42.750	0.291	15 16 43.041
December 7	16 54 25.990	0.299	16 54 26.289
26	18 18 31.830	+ 0.295	18 18 32.125

Table XX.

To show the Differences between the Sun's observed, and computed Right Ascensions; (by Greenwich observations).

1821.

		Sun's R. A. observed on the meridian of Greenwich.	Sun's R. A. computed for the meridian of Greenwich.	Difference of the observed and computed R. A.
		h. m. s.	h. m. s.	s.
June	30	6 36 4.28	6 36 3.50	+ 0.78
July	9	7 13 9.23	7 13 8.40	0.83
	12	7 25 23.69	7 25 23.00	0.69
	18	7 49 40.27	7 49 39.50	0.77
	19	7 53 41.08	7 53 40.50	0.58
August	3	8 52 48.87	8 52 48.20	0.67
	4	8 56 40.37	8 56 39.90	0.47
	10	9 19 38.07	9 19 37.30	0.77
	11	9 23 25.17	9 23 24.70	0.47
	17	9 45 58.73	9 45 57.90	0.83
	20	9 57 8.26	9 57 7.60	0.66
	21	10 0 50.94	10 0 50.00	0.94
	22	10 4 32.62	10 4 31.90	0.72
	23	10 8 13.75	10 8 13.30	0.45
	24	10 11 54.97	10 11 54.40	0.57
September	2	10 44 47.44	10 44 46.60	0.84
	3	10 48 24.69	10 48 24.00	0.69
	4	10 52 1.85	10 52 1.20	0.65
	5	10 55 38.45	10 55 38.10	0.35
	15	11 31 37.47	11 31 36.90	0.57
October	2	12 32 52.15	12 32 51.60	0.55
	21	13 43 7.39	13 43 6.50	0.89
	22	13 46 54.77	13 46 54.10	0.67
	29	14 13 47.11	14 13 46.70	0.41
	30	14 17 40.64	14 17 40.00	0.64
November	6	14 45 15.81	14 45 15.20	0.61
December	4	16 42 19.61	16 42 19.00	0.61
	5	16 46 40.49	16 46 40.40	0.09
	6	16 51 3.10	16 51 2.20	0.90
	8	16 59 47.87	16 59 47.50	0.37
	11	17 12 59.18	17 12 58.80	+ 0.38
				Mean by 31 obs. = + 0.627

Table XXI.

To show the Differences between the Sun's observed, and computed Right Ascensions; (by Greenwich observations).

1822.

		Sun's R. A. observed on the meridian of Greenwich.	Sun's R. A. computed for the meridian of Greenwich.	Difference of the observed and computed R. A.
		h. m. s.	h. m. s.	s.
January	15	19 47 12.68	19 47 12.50	+ 0.18
	16	19 51 30.44	19 51 30.00	0.44
February	21	22 17 21.84	22 17 21.50	0.34
	23	22 24 59.33	22 24 59.10	0.23
	24	22 28 47.00	22 28 47.00	0.00
	28	22 43 52.55	22 43 52.40	+ 0.15
March	1	22 47 37.20	22 47 37.30	— 0.10
April	30	2 28 32.50	2 28 32.20	+ 0.30
May	1	2 32 20.83	2 32 20.60	0.23
	21	3 50 27.49	3 50 26.70	0.79
	22	3 54 27.69	3 54 27.10	0.59
	24	4 2 30.05	4 2 29.50	0.55
	27	4 14 37.27	4 14 36.60	0.67
	31	4 30 52.93	4 30 52.60	0.33
June	1	4 34 58.18	4 34 57.70	0.48
	2	4 39 3.67	4 39 3.10	0.57
	3	4 43 9.43	4 43 9.00	0.43
	4	4 47 15.66	4 47 15.20	0.46
	6	4 55 29.28	4 55 28.60	0.68
	7	4 59 36.22	4 59 35.90	0.32
	22	6 1 51.47	6 1 50.90	0.57
July	7	7 3 57.50	7 3 56.80	0.70
	31	8 40 14.63	8 40 14.20	0.43
August	1	8 44 8.11	8 44 7.80	0.31
	2	8 48 1.27	8 48 0.70	0.57
	3	8 51 53.82	8 51 53.00	0.82
	4	8 55 45.40	8 55 44.80	0.60
	8	9 11 6.22	9 11 5.80	0.42
	17	9 45 6.16	9 45 5.70	0.46
	18	9 48 50.12	9 48 49.70	0.42
	19	9 52 33.35	9 52 33.20	0.15
	21	9 59 59.24	9 59 58.70	0.54
November	4	14 36 21.52	14 36 21.20	0.32
	9	14 56 19.00	14 56 19.00	0.00
	13	15 12 33.11	15 12 32.80	0.31
	14	15 16 38.72	15 16 38.40	0.32
	29	16 19 39.38	16 19 38.90	0.48
December	6	16 49 59.24	16 49 58.70	0.54
	7	16 54 21.47	16 54 21.00	0.47
	8	16 58 44.49	16 58 43.90	0.59
	22	18 0 41.17	18 0 40.80	0.37
	23	18 5 7.68	18 5 7.40	0.28
	26	18 18 27.31	18 18 26.90	0.41
	28	18 27 19.79	18 27 19.40	0.39
	30	18 36 11.80	18 36 11.00	+ 0.80
			Mean by 45 obs. =	+ 0.420

Table XXII.

To show the Differences between the Sun's observed, and computed Right Ascensions. (By Paris Observations.)

1821.

		Sun's R. A. observed at Paris, reduced by the Greenwich Catalogue.	Sun's R. A. computed for the Meridian of Paris.	Difference of the observed and computed R. A.
		h. m. s.	h. m. s.	s.
July	18	7 49 38.210	7 49 37.935	+ 0.275
	19	7 53 39.470	7 53 38.938	0.532
August	20	9 57 6.830	9 57 6.156	0.674
	21	10 0 48.970	10 0 48.559	0.411
	22	10 4 31.150	10 4 30.462	0.688
	23	10 8 12.780	10 8 11.864	0.916
	24	10 11 53.790	10 11 52.968	0.822
September	2	10 44 46.000	10 44 45.188	0.812
	4	10 52 0.440	10 51 59.792	0.648
	5	10 55 37.360	10 55 36.693	0.667
October	2	12 32 50.600	12 32 50.185	0.415
	21	13 43 5.940	13 43 5.022	0.918
	29	14 13 45.630	14 13 45.185	0.445
	30	14 17 38.810	14 17 38.480	0.330
November	6	14 45 14.010	14 45 13.644	0.366
December	4	16 42 17.720	16 42 17.303	+ 0.417
			Mean by 16 obs. =	+ 0.584

Table XXIII.

To show the Differences between the Sun's observed, and computed Right Ascensions. (By Paris Observations.)

1822.

		Sun's R. A. observed at Paris, reduced by the Greenwich Catalogue.	Sun's R. A. computed for the Meridian of Paris.	Difference of the observed and computed R. A.
		h. m. s.	h. m. s.	s.
January	15	19 47 10.900	19 47 10.828	+ 0.072
February	21	22 17 20.650	22 17 20.013	0.637
	23	22 24 57.990	22 24 57.620	0.370
	28	22 43 51.550	22 43 50.940	0.610
March	1	22 47 36.280	22 47 35.844	0.436
April	30	2 28 30.890	2 28 30.717	0.173
May	1	2 32 19.580	2 32 19.114	0.466
	21	3 50 25.630	3 50 25.140	0.490
	22	3 54 26.620	3 54 25.536	1.084
	31	4 30 51.780	4 30 51.009	0.771
June	1	4 34 56.340	4 34 56.107	0.233
	2	4 39 2.130	4 39 1.503	0.627
	3	4 43 8.220	4 43 7.401	0.819
	4	4 47 14.230	4 47 13.599	0.631
	6	4 55 27.600	4 55 26.994	0.606
	7	4 59 35.430	4 59 34.293	1.137
July	4	6 51 35.200	6 51 34.595	0.605
	10	7 16 13.890	7 16 12.809	1.081
August	1	8 44 6.260	8 44 6.288	0.972
	2	8 48 0.060	8 47 59.192	0.868
	17	9 45 4.630	9 45 4.246	0.384
	18	9 48 48.600	9 48 48.249	0.351
November	26	16 6 47.850	16 6 47.438	0.412
December	6	16 49 57.380	16 49 56.997	0.383
	7	16 54 19.960	16 54 19.293	0.667
	22	18 0 39.190	18 0 39.069	0.121
	26	18 18 25.330	18 18 25.171	0.159
	28	18 27 18.120	18 27 17.673	+ 0.447
			Mean by 28 obs. =	+ 0.558

Table XXIV.

To show the Differences between the Sun's observed, and computed Right Ascensions; (by Dublin observations.)

1821.

		Sun's R. A. observed at Dublin, reduced by the Greenwich Catalogue.	Sun's R. A. computed for the meridian of Dublin Observatory.	Diff. of the observed and computed R. A.
		h. m. s.	h. m. s.	s.
June	30	6 36 8.781	6 36 7.842	+ 0.939
July	12	7 25 28.162	7 25 27.298	0.864
	19	7 53 45.548	7 53 44.737	0.811
August	23	10 8 17.857	10 8 17.195	0.662
	24	11 11 59.155	10 11 58.286	0.869
October	2	12 32 55.797	12 32 55.440	0.357
	29	14 13 51.311	14 13 50.810	0.501
December	6	16 51 7.391	16 51 6.822	0.569
	11	17 13 3.878	17 13 3.459	+ 0.419
			Mean by 9 obs. =	+ 0.666

Table XXV.

To show the Differences between the Sun's observed, and computed Right Ascensions; (by Dublin observations.)

1822.

		Sun's R. A. observed at Dublin, reduced by the Greenwich Catalogue.	Sun's R. A. computed for the meridian of Dublin Observatory.	Diff. of the observed and computed R. A.
		h. m. s.	h. m. s.	s.
May	1	2 32 25.302	2 32 24.630	+ 0.672
	21	3 50 31.846	3 50 30.933	0.913
	22	3 54 32.209	3 54 31.344	0.865
	24	4 2 34.538	4 2 33.761	0.777
June	1	4 35 2.653	4 35 2.023	0.630
	3	4 43 14.143	4 43 13.337	0.806
	6	4 55 33.963	4 55 32.956	1.007
	7	4 59 40.987	4 59 40.260	0.727
	22	6 1 56.049	6 1 55.297	0.752
August	2	8 48 5.514	8 48 4.792	0.722
	19	9 52 37.663	9 52 37.128	0.535
	21	10 0 2.983	10 0 2.611	0.372
November	14	15 16 43.041	15 16 42.740	0.301
December	7	16 54 26.289	16 54 25.631	0.658
	26	18 18 32.125	18 18 31.573	+ 0.552
			Mean by 15 obs. =	+ 0.686

JAMES SOUTH.

Sloane Street,
May 24, 1826.

The following was received from Dr. Young whilst the preceding Memoir was in the press.

JAMES SOUTH.

Park Square, 10th July, 1826.

Dear Sir,

I send you some computations of the Sun's longitude from the observations made at Greenwich in 1820, compared with Delambre's Tables, as corrected by Burckhardt and Bouvard, and with Carlini's, as modified by some slight corrections communicated by Professor Schumacher. The calculations have been made at the expense of the Board of Longitude; and if you think they would tend to illustrate the subject of your Paper, you will perhaps have no objection to inserting them as a note at the end. I have had the same observations reduced by an able astronomer in Germany; but the results are not immediately comparable with these, as they show the errors in right ascension only; and they make the error of Carlini's tables rather greater than is here represented, amounting to about — 8″ on an average, instead of — 3″ or + 1″; so that the mode of reduction appears to require some further examination.

I am, Dear Sir,

Your faithful and obedient Servant,

THOMAS YOUNG, M. D.

Sec. Bd. Long.

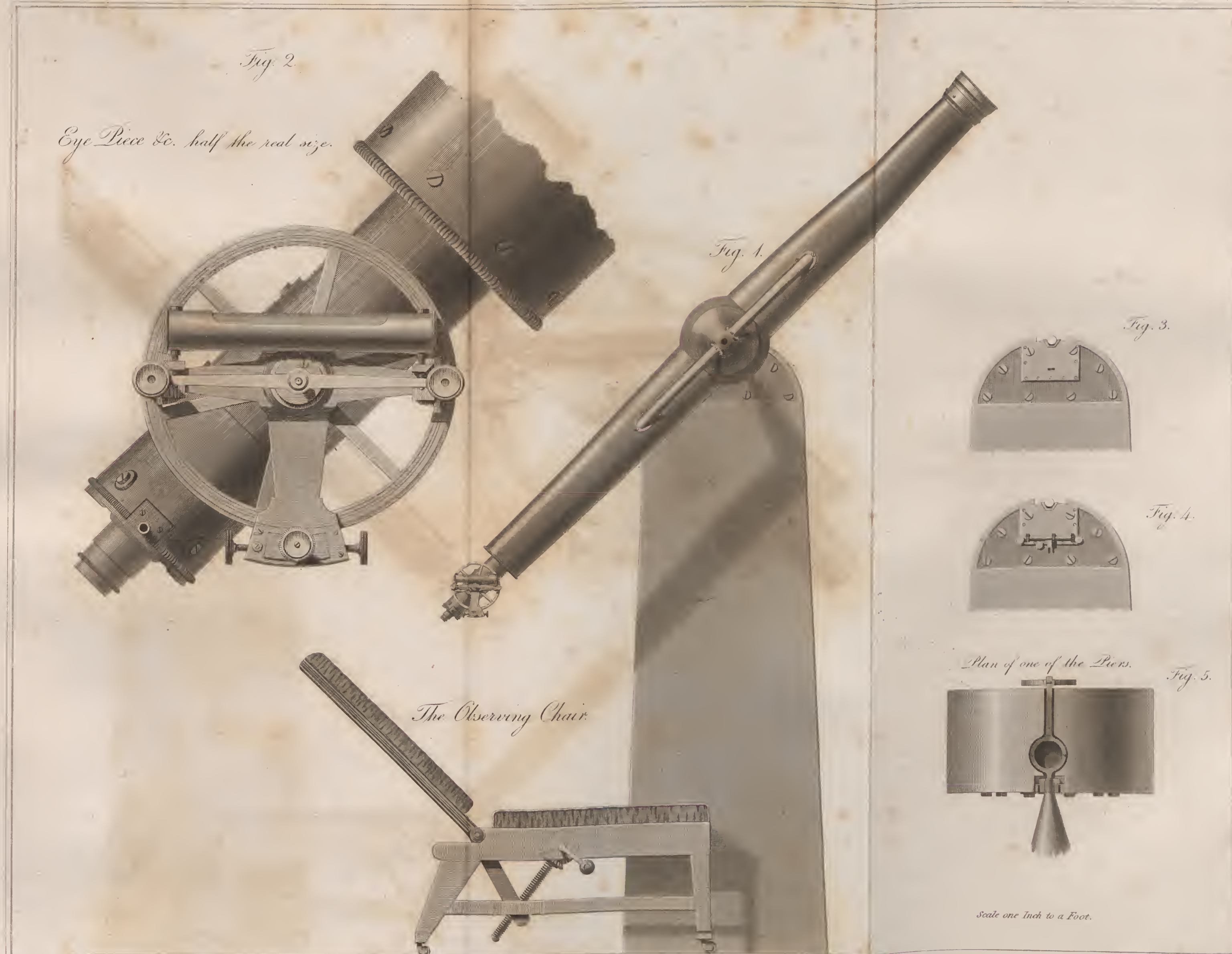
James South, Esq. &c. &c. &c.

Date.	The Sun's Longitude, by: Observation.	Delambre's Tables improved.	Carlini's Tables.	Carlini's Tables improved.	Error of Delambre's Tables improved.	Error of Carlini's Tables.	Error of Carlini's Tables improved.
1820.	° ′ ″	° ′ ″	° ′ ″	° ′ ″	″	″	″
Jan. 1	280 3 48,2	280 3 52,9	280 3 47,2	280 3 51,2	+ 4,7	— 1,0	+ 3,0
3	282 6 7,9	282 6 12,8	282 6 6,8	282 6 11,9	+ 4,9	— 1,1	+ 4,0
5	284 8 27,3	284 8 33,2	284 8 26,8	284 8 32,0	+ 5,9	— 0,5	+ 4,7
15	294 20 8,0	294 20 12,8	294 20 6,9	294 20 11,6	+ 4,8	— 1,1	+ 3,6
16	295 21 20,0	295 21 21,2	295 21 15,7	295 21 20,1	+ 1,2	— 4,3	+ 0,1
22	301 27 51,9	301 27 54,6	301 27 49,0	301 27 52,9	+ ,7	— 2,9	+ 1,0
23	302 28 52,2	302 28 56,6	302 28 51,1	302 28 55,0	+ 4,4	— 1,1	+ 2.8
27	306 32 47,4	306 32 52,2	306 32 46,7	306 32 50,7	+ 4,8	— 0,7	+ 3,3
31	310 36 23,7	310 36 29,8	310 36 23,6	310 36 28,0	+ 6,1	— 0,1	+ 4,3

Date.	The Sun's Longitude, by Observation.	Delambre's Tables improved.	Carlini's Tables.	Carlini's Tables improved.	Error of Delambre's Tables improved.	Error of Carlini's Tables.	Error of Carlini's Tables improved.
1820.	° ′ ″	° ′ ″	° ′ ″	° ′ ″	″	″	″
Feb. 1	311 37 16,0	311 37 21,6	311 37 15,3	311 37 19,8	+ 5,6	— 0,7	+ 3,8
14	324 46 54,9	324 46 57,8	324 46 53,3	324 46 57,0	+ 2,9	— 1,6	+ 2,1
15	325 47 25,0	325 47 33,4	325 47 29,0	325 47 32,6	+ 8,4	+ 4,0	+ 7,6
16	326 48 5,3	326 48 7,5	326 48 3,1	326 48 6,6	+ 2,2	— 2,2	+ 1,3
17	327 48 38,8	327 48 39,8	327 48 35,3	327 48 38,7	+ 1,0	— 3,5	— 0,1
21	331 50 27,0	331 50 29,3	331 50 25,3	331 50 28,5	+ 2,3	— 1,7	+ 1,5
27	337 52 16,0	337 52 14,7	337 52 10,5	337 52 13,9	— 1,3	— 5,5	— 2,1
28	338 52 25,3	338 52 25,7	338 52 21,4	338 52 24,8	+ 0,4	— 3,9	— 0,5
29	339 52 35,3	339 52 34,5	339 52 30,3	339 52 33,7	— 0,8	— 5,0	— 1,6
March 8	347 52 39,5	347 52 43,5	347 52 39,8	347 52 43,5	+ 4,0	+ 0,3	+ 4,0
9	348 52 39,3	348 52 37,1	348 52 33,3	348 52 36,8	— 2,2	— 6,0	— 2,5
10	349 52 28,7	349 52 29,3	349 52 26,0	349 52 29,5	+ 0,6	— 2,7	+ 0,8
11	350 52 23,3	350 52 19,5	350 52 16,4	350 52 19,8	— 3,8	— 6,9	— 3,5
13	352 51 57,8	352 51 54,4	352 51 52,0	352 51 55,2	— 3,4	— 5,8	— 2,6
15	354 51 24,9	354 51 21,9	354 51 19,5	354 51 22,4	— 3,0	— 5,4	— 2,5
23	2 47 48,5	2 47 44,2	2 47 42,5	2 47 44,7	— 4,3	— 6,0	— 3,8
30	9 42 34,9	9 42 34,2	9 42 31,6	9 42 34,3	— 0,7	— 3,3	— 0,6
April 5	15 36 52,2	15 36 49,4	15 36 47,5	15 36 50,5	— 2,8	— 4,7	— 1,7
7	17 34 36,0	17 34 40,4	17 34 38,7	17 34 41,7	+ 4,4	+ 2,7	+ 5,7
11	21 30 3,7	21 30 1,6	21 30 0,4	21 30 3,0	— 2,1	— 3,3	— 0,7
15	25 24 55,7	25 24 53,1	25 24 52,1	25 24 54,3	— 2,0	— 3,6	— 1,4
17	27 22 6,4	27 22 6,6	27 22 6,1	27 22 8,0	+ 0,2	— 0,3	+ 1,6
18	28 20 42,8	28 20 40,0	28 20 39,4	28 20 41,2	— 2,8	— 3,4	— 1,6
19	29 19 14,1	29 19 11,3	29 19 10,8	29 19 12,6	— 2,8	— 3,3	— 1,5
21	31 16 10,5	31 16 7,3	31 16 6,6	31 16 8,4	— 3,2	— 3,9	— 2,1
22	32 14 31,4	32 14 32,1	32 14 31,3	32 14 33,1	+ 0,7	— 0,1	+ 1,7
23	33 12 55,7	33 12 54,8	33 12 53,9	33 12 55,7	— 0,9	— 1,8	0,0
24	34 11 15,4	34 11 15,3	34 11 14,3	34 11 16,2	— 0,1	— 1,1	+ 0,8
25	35 9 38,8	35 9 33,8	35 9 32,7	35 9 34,7	— 5,0	— 6,1	— 4,1
26	36 7 53,7	36 7 50,6	36 7 49,0	36 7 51,1	— 3,1	— 4,7	— 2,6
28	38 4 21,1	38 4 18,4	38 4 16,6	38 4 19,0	— 2,7	— 4,5	— 2,1
29	39 2 34,3	39 2 29,6	39 2 27,6	39 2 30,1	— 4,7	— 6,7	— 4,2
May 5	44 51 3,5	44 51 4,1	44 51 2,6	44 51 5,3	+ 0,6	— 0,9	+ 1,8
7	46 47 9,4	46 47 5,0	46 47 3,4	46 47 6,1	— 4,4	— 6,0	— 3,3
12	51 36 46,7	51 36 44,4	51 36 43,0	51 36 45,2	— 2,3	— 3,7	— 1,5
15	54 30 16,7	54 30 14,9	54 30 13,9	54 30 15,8	— 1,8	— 2,8	— 0,9
21	60 16 33,5	60 16 33,5	60 16 32,6	60 16 34,4	0,0	— 0,9	+ 0,9
22	61 14 9,9	61 14 11,2	61 14 10,0	61 14 11,9	+ 1,3	+ 0,1	+ 2,0
23	62 11 47,8	62 11 47,3	62 11 46,0	62 11 48,0	— 0,5	— 1,8	+ 0,2
24	63 9 23,5	63 9 21,9	63 9 20,7	63 9 22,8	— 1,6	— 2,8	— 0,7
June 1	70 49 18,5	70 49 18,4	70 49 16,0	70 49 18,0	— 0,1	— 2,5	+ 0,3
17	86 7 0,9	86 6 59,3	86 6 57,3	86 6 59,6	— 1,6	— 3,6	— 1,3
23	91 50 20,9	91 50 22,2	91 50 19,3	91 50 22,0	+ 1,3	— 1,6	+ 1,1
24	92 47 33,9	92 47 33,9	92 47 30,8	92 47 33,7	0,0	— 3,1	— 0,2
25	93 44 50,1	93 44 45,4	93 44 42,0	93 44 44,9	— 4,7	— 8,1	— 5,2
26	94 41 56,2	94 41 56,5	94 41 53,0	94 41 56,0	+ 0,3	— 3,2	— 0,2
27	95 39 6,6	95 39 7,3	95 39 3,8	95 39 7,0	+ 0,7	— 2,8	+ 0,4
28	96 36 17,0	96 36 18,1	96 36 14,8	96 36 18,2	+ 1,1	— 2,2	+ 1,2
29	97 33 27,4	97 33 29,1	97 33 25,8	97 33 29,3	+ 1,7	— 1,6	+ 1,9

Date.	The Sun's Longitude, by Observation.	Delambre's Tables improved	Carlini's Tables.	Carlini's Tables improved.	Error of Delambre's Tables improved.	Error of Carlini's Tables.	Error of Carlini's Tables improved.
1820.	° ′ ″	° ′ ″	° ′ ″	° ′ ″	″	″	″
July 10	108 2 47,2	108 2 49,8	108 2 45,8	108 2 49,2	+ 2,6	— 1,4	+ 2,0
11	109 0 2,6	109 0 4,3	109 0 0,6	109 0 3,9	+ 1,7	— 2,0	+ 1,3
19	116 38 7,1	116 38 8,6	116 38 4,8	116 38 8,1	+ 1,5	— 2,3	+ 1,0
24	121 24 33,5	121 24 34,8	121 24 30,1	121 24 33,7	+ 1,3	— 3,4	+ 0,2
27	124 16 34,8	124 16 32,4	124 16 28,1	124 16 32,2	— 2,4	— 6,7	— 2,6
30	127 8 40,4	127 8 39,2	127 8 34,7	127 8 38,9	— 1,2	— 5,7	— 1,5
Aug. 1	129 3 28,4	129 3 28,9	129 3 24,4	129 3 29,0	+ 0,5	— 4,0	+ 0,6
7	134 48 29,5	134 48 29,9	134 48 24,9	134 48 29,4	+ 0,4	— 4,6	— 0,1
8	135 46 4,0	135 46 4,3	135 45 59,4	135 46 3,8	+ 0,3	— 4,6	— 0,2
9	136 43 40,1	136 43 39,8	136 43 35,1	136 43 39,4	— 0,3	— 5,0	— 0,7
10	137 41 16,1	137 41 16,8	137 41 11,9	137 41 16,1	+ 0,7	— 4,2	0,0
11	138 38 54,3	138 38 54,6	138 38 49,8	138 38 53,9	+ 0,3	— 4,5	— 0,4
12	139 36 34,7	139 36 33,4	139 36 28,7	139 36 32,8	— 1,3	— 6,0	— 1,9
13	140 34 9,5	140 34 13,1	140 34 8,7	140 34 12,7	+ 3,6	— 0,8	+ 3,2
14	141 31 54,0	141 31 53,7	141 31 49,6	141 31 53,6	— 0,3	— 4,4	— 0,4
18	145 22 46,9	145 22 48,4	145 22 43,6	145 22 47,6	+ 1,5	— 3,3	+ 0,7
19	146 20 35,1	146 20 34,6	146 20 29,7	146 20 33,8	— 0,5	— 5 4	— 1,3
20	147 18 21,5	147 18 21,6	147 18 17,0	147 18 21,3	+ 0,1	— 4 5	— 0,2
27	154 3 35,5	154 3 31,9	154 3 27,3	154 3 32,3	— 3,6	— 8,2	— 3,2
29	155 59 37,0	155 59 32,0	155 59 27,2	155 59 32,5	— 5,0	— 9 8	— 4,5
30	156 57 41,3	156 57 36,4	156 57 31,4	156 57 36,7	— 4,9	— 9,9	— 4,6
Sept. 1	158 53 46,2	158 53 49,4	158 53 44,0	158 53 49,3	+ 3,2	— 2,2	+ 3,1
2	159 52 0,3	159 51 58,9	159 51 53,6	159 51 58,8	— 1,4	— 6,7	— 1,5
3	160 50 14,0	160 50 10,5	160 50 4,9	160 50 10,1	— 3,5	— 9,1	— 3,9
4	161 48 22,7	161 48 23,6	161 48 18,2	161 48 23,4	+ 0,9	— 4,5	+ 0,7
5	162 46 39,0	162 46 38,8	162 46 33,5	162 46 38,6	— 0,2	— 5,5	— 0,4
6	163 44 51,0	163 44 55,7	163 44 50,6	163 44 55,6	+ 4,7	— 0,4	+ 4,6
7	164 43 14,3	164 43 15,1	164 43 9,9	164 43 14,8	+ 0,8	— 4,4	+ 0,5
8	165 41 32,5	165 41 35,7	165 41 30,7	165 41 35,5	+ 3,2	— 1,8	+ 3,0
9	166 39 55,1	166 39 58,2	166 39 53,7	166 39 58,5	+ 3,1	— 1,4	+ 3,4
10	167 38 22,6	167 38 22,5	167 38 18,1	167 38 22,8	— 0,1	— 4,5	+ 0,2
11	168 36 42,0	168 36 48,3	168 36 44,1	168 36 48,7	+ 6,3	+ 2,1	+ 6,7
13	170 33 43,9	170 33 45,3	170 33 41,4	170 33 45,9	+ 1,4	— 2,5	+ 2,0
19	176 25 14,2	176 25 15,8	176 25 11,8	176 25 16,5	+ 1,6	— 2,4	+ 2,3
24	181 18 58,0	181 18 59,9	181 18 55,7	181 19 0,9	+ 1,9	— 2,3	+ 2,9
Oct. 3	190 9 58,1	190 10 2,5	190 9 57,1	190 10 2,6	+ 4,4	— 1,0	+ 4,5
5	192 8 25,4	192 8 28,3	192 8 23,0	192 8 28,3	+ 2,9	— 2,4	+ 2,9
6	193 7 41,2	193 7 44,5	193 7 39,5	193 7 44,7	+ 3,3	— 1,7	+ 3,5
12	199 3 59,1	199 4 3,5	199 3 59,7	199 4 4,4	+ 4,4	+ 0,6	+ 5,3
17	204 1 51,1	204 1 50,5	204 1 46,4	204 1 51,0	— 0,6	— 4,7	— 0,1
28	214 59 42,4	214 59 43,4	214 59 38,4	214 59 43,7	+ 1,0	— 4,0	+ 1,3
Nov. 2	220 0 8,0	220 0 11,4	220 0 6,5	220 0 11,6	+ 3,4	— 1,5	+ 3,6
3	221 0 22,1	221 0 23,4	221 0 18,7	221 0 23,7	+ 1,3	— 3,4	+ 1,6
16	234 5 28,7	234 5 32,2	234 5 28,3	234 5 32,4	+ 3,5	— 0,4	+ 3,7
18	236 6 35,6	236 6 40,4	236 6 36,8	236 6 41,1	+ 4,8	+ 1,2	+ 5,5
19	237 7 10,3	237 7 16,7	237 7 13,1	237 7 17,5	+ 6,4	+ 2,8	+ 7,2
27	245 12 51,7	245 13 1,0	245 12 56,4	245 13 1,2	+ 9,3	+ 4,7	+ 9,5
Dec. 14	262 29 41,5	262 29 47,0	262 29 43,3	262 29 46,6	+ 5,5	+ 1,8	+ 5,1
28	276 45 34,6	276 45 40,6	276 45 35,7	276 45 39,5	+ 6,0	+ 1,1	+ 4,9
					+ 177,0	+ 21,4	+ 164,5
					— 94,6	— 335,6	— 83,6
					± 271,6	± 357,0	± 248,1
					+ 82,4	— 314,2	+ 80,9

Printed by W. Nicol,
Cleveland-row, St. James's.



J. Bradley, del. J. Basire sc.

Made for the Observatory of his Friend James South Esq.re by Edward Troughton.

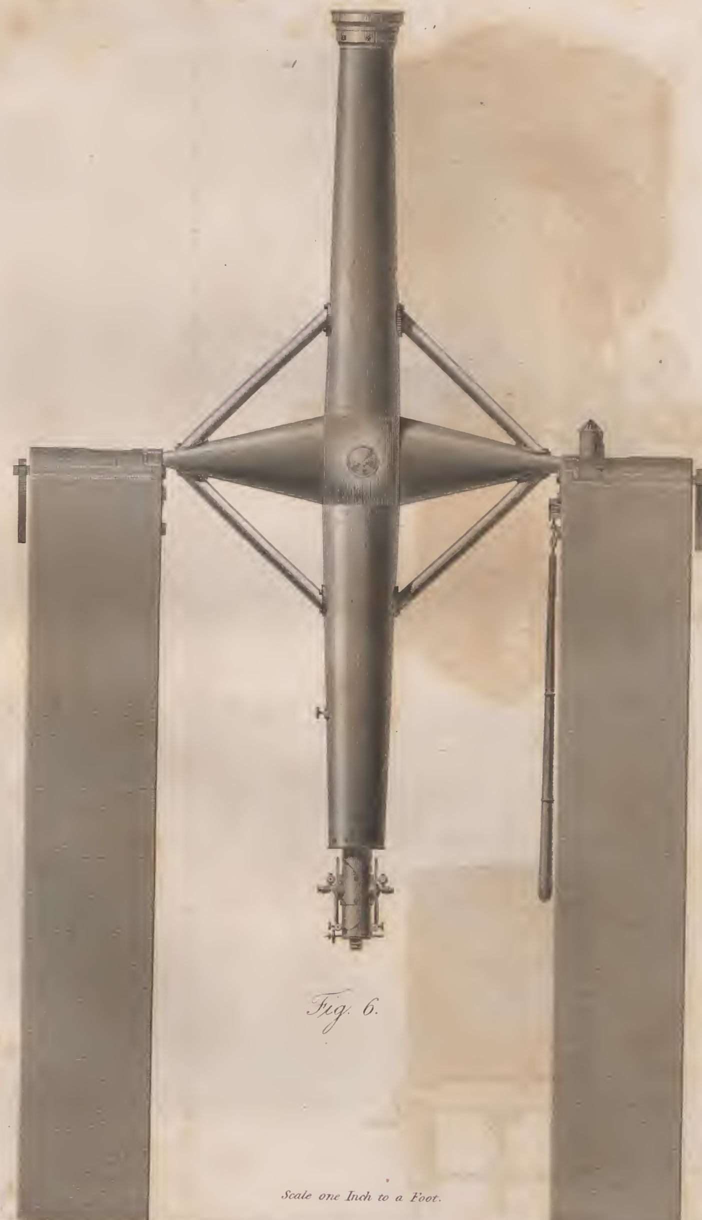
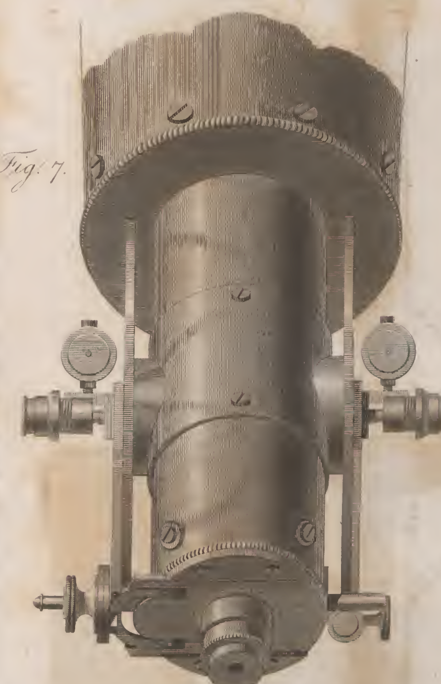


Fig. 6.

Scale one Inch to a Foot.

Fig. 7.



Front of the Eye Piece.

Back of the Observing Chair.

T. Bradley, del.

Erected June 6th 1820.

Section through the Transverse Axis.

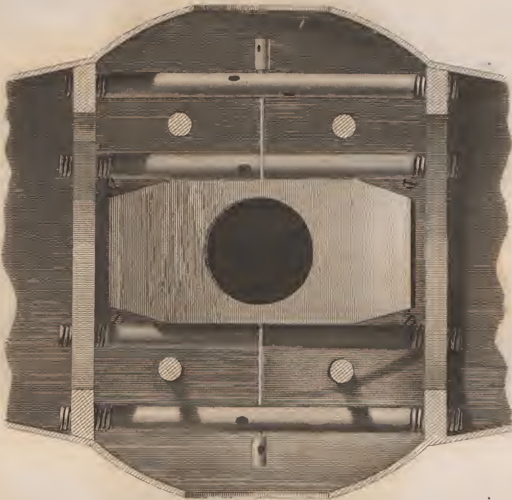


Fig. 8.

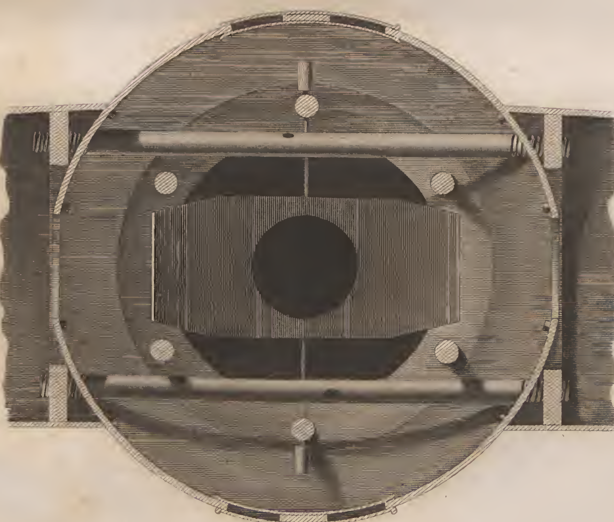


Fig. 9.

Section through the Axis of the Telescope.

Scale of 0 1 2 3 4 5 6 7 8 9 10 11 12 Inches.

T. Bradley. del.

J. Basire sc.